Keystone Algebra I Practice Workbook
2012-2013

Harrisburg School District, Harrisburg, PA

Name: ________________________________

Info

Info

About this workbook…

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Modules 1 & 2 and the **Constructed Response** section are PDE examples of what will be on the exam.

The first problems listed in the **CR2** sections were also issued by the PDE, the rest were created by the team.

Please email anyone on the last page with corrections, suggestions or examples that you would like to see included in future editions.

Algebra I Keystone Exam Quick Facts

Assessment Anchors Covered	Module 1: Operations and Linear Equations and Inequalities	Module 2: Linear Functions and Data Organization	Total
Number of Multiple Choice Questions	23	23	46
Number of Constructed Response Questions	4	4	8

Keystone Exam Scale Score Ranges

Content Area	BELOW BASIC	BASIC	PROFICIENT	ADVANCED
Algebra I	1200–1438	1439–1499	1500–1545	1546–1800
Biology	1200–1459	1460–1499	1500–1548	1549–1800
Literature	1200– 1443	1444–1499	1500–1583	1584–1800

Estimated time to take the test is 2.5 hours.

Constructed Response Questions

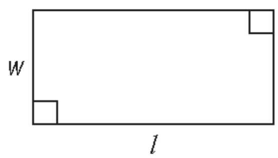
The Algebra I Keystone Exam will have two different types of constructed-response questions. Both types of constructed-response questions will be scored on a scale ranging from 0–4 points.

Scaffolding Completion Questions are constructed-response questions that elicit two-to-four distinct responses from a student. When administered online, the responses are electronically entered by the student and are objective and concise. Some examples of student responses may be *5 gallons, vertex at (5, 11), or y = 3x + 9.* A designated answer space/box will be provided for each part of the question. No extraneous work or explanation will be scored. To the greatest extent possible, automated scoring will be used to determine the point value of the responses. When applicable, Inferred Partial Credit Rubrics and Scoring Guides will be used to award partial credit to qualifying responses.

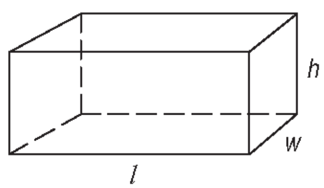
Extended Scaffolding Completion Questions are constructed-response questions that require students to respond with extraneous work or explanation for at least part of the question. For example, the student may be asked to “Show all of your work,” “Explain why the curve is not a parabola,” or “What is the error in Jill’s reasoning?” When administered online, responses can be typed by the student, but scoring will not be automated. Question-specific scoring guides will be used by scorers to award credit, including partial credit, for responses.

ALGEBRA I FORMULA SHEET

Formulas that you may need to solve questions on this exam are found below.
You may use calculator π or the number 3.14.



$A = lw$



$V = lwh$

Linear Equations

Slope: $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

Point-Slope Formula: $(y - y_1) = m(x - x_1)$

Slope-Intercept Formula: $y = mx + b$

Standard Equation of a Line: $Ax + By = C$

Arithmetic Properties

Additive Inverse: $a + (^-a) = 0$

Multiplicative Inverse: $a \cdot \dfrac{1}{a} = 1$

Commutative Property: $a + b = b + a$
$a \cdot b = b \cdot a$

Associative Property: $(a + b) + c = a + (b + c)$
$(a \cdot b) \cdot c = a \cdot (b \cdot c)$

Identity Property: $a + 0 = a$
$a \cdot 1 = a$

Distributive Property: $a \cdot (b + c) = a \cdot b + a \cdot c$

Multiplicative Property of Zero: $a \cdot 0 = 0$

Additive Property of Equality:
If $a = b$, then $a + c = b + c$

Multiplicative Property of Equality:
If $a = b$, then $a \cdot c = b \cdot c$

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Module 1

Operations, Linear Equations & Inequalities

Rubric:

1 point for each correct answer: multiple choice.

M O D 1

A1.1.1 Operations with Real Numbers and Expressions

ASSESSMENT ANCHOR A1.1.1 Operations with Real Numbers and Expressions		
Anchor Descriptor	**Eligible Content**	**PA Common Core Standards**
A1.1.1.1 Represent and/or use numbers in equivalent forms (e.g., integers, fractions, decimals, percents, square roots, and exponents).	**A1.1.1.1.1** Compare and/or order any real numbers. Note: Rational and irrational may be mixed. **A1.1.1.1.2** Simplify square roots (e.g., $\sqrt{24} = 2\sqrt{6}$).	**CC.2.1.8.E.1** Distinguish between rational and irrational numbers using their properties. **CC.2.1.8.E.4** Estimate irrational numbers by comparing them to rational numbers. **CC.2.1.HS.F.1** Apply and extend the properties of exponents to solve problems with rational exponents. **CC.2.1.HS.F.2** Apply properties of rational and irrational numbers to solve real world or mathematical problems.
Anchor Descriptor	**Eligible Content**	**PA Common Core Standards**
A1.1.1.2 Apply number theory concepts to show relationships between real numbers in problem-solving settings.	**A1.1.1.2.1** Find the Greatest Common Factor (GCF) and/or the Least Common Multiple (LCM) for sets of monomials.	**CC.2.1.6.E.3** Develop and/or apply number theory concepts to find common factors and multiples.
Anchor Descriptor	**Eligible Content**	**PA Common Core Standards**
A1.1.1.3 Use exponents, roots, and/or absolute values to solve problems.	**A1.1.1.3.1** Simplify/evaluate expressions involving properties/laws of exponents, roots, and/or absolute values to solve problems. Note: Exponents should be integers from -10 to 10.	**CC.2.1.HS.F.1** Apply and extend the properties of exponents to solve problems with rational exponents. **CC.2.1.HS.F.2** Apply properties of rational and irrational numbers to solve real world or mathematical problems. **CC.2.2.8.B.1** Apply concepts of radicals and integer exponents to generate equivalent expressions.

Anchor Descriptor	**Eligible Content**	**PA Common Core Standards**
A1.1.1.4 Use estimation strategies in problem-solving situations.	**A1.1.1.4.1** Use estimation to solve problems.	**CC.2.2.7.B.3** Model and solve real-world and mathematical problems by using and connecting numerical, algebraic, and/or graphical representations. **CC.2.2.HS.D.9** Use reasoning to solve equations and justify the solution method.
Anchor Descriptor	**Eligible Content**	**PA Common Core Standards**
A1.1.1.5 Simplify expressions involving polynomials.	**A1.1.1.5.1** Add, subtract, and/or multiply polynomial expressions (express answers in simplest form). Note: Nothing larger than a binomial multiplied by a trinomial. **A1.1.1.5.2** Factor algebraic expressions, including difference of squares and trinomials. Note: Trinomials are limited to the form ax^2+bx+c where a is equal to 1 after factoring out all monomial factors. **A1.1.1.5.3** Simplify/reduce a rational algebraic expression.	**CC.2.2.HS.D.1** Interpret the structure of expressions to represent a quantity in terms of its context. **CC.2.2.HS.D.2** Write expressions in equivalent forms to solve problems. **CC.2.2.HS.D.3** Extend the knowledge of arithmetic operations and apply to polynomials. **CC.2.2.HS.D.5** Use polynomial identities to solve problems. **CC.2.2.HS.D.6** Extend the knowledge of rational functions to rewrite in equivalent forms.

1. Which of the following inequalities is true for all real values of *x*?

A. $x^3 \geq x^2$

B. $3x^2 \geq 2x^3$

C. $(2x)^2 \geq 3x^2$

D. $3(x - 2)^2 \geq 3x^2 - 2$

2. An expression is shown below.

$$2\sqrt{\quad}$$

Which value of *x* makes the expression equivalent to $10\sqrt{\quad}$?

A. 5

B. 25

C. 50

D. 100

MOD 1

3. An expression is shown below.

$$\sqrt{\quad}$$

For which value of *x* should the expression be further simplified?

A. $x = 10$

B. $x = 13$

C. $x = 21$

D. $x = 38$

4. Two monomials are shown below.

$$450x^2y^5 \qquad\qquad 3{,}000x^4y^3$$

What is the least common multiple (LCM) of these monomials?

A. $2xy$

B. $30xy$

C. $150x^2y^3$

D. $9{,}000x^4y^5$

5. Simplify:

$$2(2\sqrt{})^{-2}$$

A. –

B. –

C. 16

D. 32

6. A theme park charges $52 for a day pass and $110 for a week pass. Last month, 4,432 day passes were sold and 979 week passes were sold. Which is the closest estimate of the total amount of money paid for the day and week passes for last month?

A. $300,000

B. $400,000

C. $500,000

D. $600,000

7. A polynomial expression is shown below.

$$(mx^3 + 3)\,(2x^2 + 5x + 2) - (8x^5 + 20x^4\,)$$

The expression is simplified to $8x^3 + 6x^2 + 15x + 6$.
What is the value of m?

A. -8

B. -4

C. 4

D. 8

8. When the expression $x^2 - 3x - 18$ is factored completely, which is one of its factors?

A. $(x - 2)$

B. $(x - 3)$

C. $(x - 6)$

D. $(x - 9)$

9. Which is a factor of the trinomial $x^2 - 2x - 15$?

A. $(x - 13)$

B. $(x - 5)$

C. $(x + 5)$

D. $(x + 13)$

10. Simplify:

$$\frac{- \qquad -}{\qquad\qquad} ;\ x \neq -4, -2$$

A. $\frac{\quad}{\quad}x - -$

B. $x^2 - -x - -$

C. $\frac{-}{\qquad}$

D. $\frac{\qquad}{-}$

11. Simplify:

$$\frac{-}{- \quad -} \; ; \; x \neq -4, -2, 0$$

A. $\frac{\quad}{\quad} x^2 - -x$

B. $x^3 - -x^2 - -x$

C. $\frac{\quad}{-}$

D. $\frac{-}{\quad}$

A1.1.2 Linear Equations

ASSESSMENT ANCHOR A1.1.2 Linear Equations		
Anchor Descriptior	**Eligible Content**	**PA Common Core Standards**
A1.1.2.1 Write, solve, and/or graph linear equations using various methods.	**A1.1.2.1.1** Write, solve, and/or apply a linear equation (including problem situations). **A1.1.2.1.2** Use and/or identify an algebraic property to justify any step in an equation-solving process. Note: Linear equations only. **A1.1.2.1.3** Interpret solutions to problems in the context of the problem situation. Note: Linear equations only.	**CC.2.2.8.B.3** Analyze and solve linear equations and pairs of simultaneous linear equations. **CC.2.1.HS.F.3** Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs and data displays. **CC.2.1.HS.F.4** Use units as a way to understand problems and to guide the solution of multi-step problems. **CC.2.1.HS.F.5** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. **CC.2.2.HS.D.7** Create and graph equations or inequalities to describe numbers or relationships. **CC.2.2.HS.D.8** Apply inverse operations to solve equations or formulas for a given variable. **CC.2.2.HS.D.9** Use reasoning to solve equations and justify the solution method. **CC.2.2.HS.D.10** Represent, solve and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically. **CC.2.2.HS.C.3** Write functions or sequences that model relationships between two quantities.

Anchor Descriptor	Eligible Content	PA Common Core Standards
A1.1.2.2 Write, solve, and/or graph systems of linear equations using various methods.	**A1.1.2.2.1** Write and/or solve a system of linear equations (including problem situations) using graphing, substitution, and/or elimination. Note: Limit systems to two linear equations. **A1.1.2.2.2** Interpret solutions to problems in the context of the problem situation. Note: Limit systems to two linear equations.	**CC.2.2.8.B.3** Analyze and solve linear equations and pairs of simultaneous linear equations. **CC.2.2.HS.D.9** Use reasoning to solve equations and justify the solution method. **CC.2.2.HS.D.10** Represent, solve and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically. **CC.2.1.HS.F.5** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

12. Jenny has a job that pays her \$8 per hour plus tips (t). Jenny worked for 4 hours on Monday and made \$65 in all. Which equation could be used to find t, the amount Jenny made in tips?

A. $65 = 4t + 8$

B. $65 = 8t \div 4$

C. $65 = 8t + 4$

D. $65 = 8(4) + t$

13. One of the steps Jamie used to solve an equation is shown below.

$$-5(3x + 7) = 10$$
$$-15x + {}^{-}35 = 10$$

Which statements describe the procedure Jamie used in this step and identify the property that justifies the procedure?

A. Jamie added –5 and $3x$ to eliminate the parentheses. This procedure is justified by the associative property.

B. Jamie added –5 and $3x$ to eliminate the parentheses. This procedure is justified by the distributive property.

C. Jamie multiplied $3x$ and 7 by –5 to eliminate the parentheses. This procedure is justified by the associative property.

D. Jamie multiplied $3x$ and 7 by –5 to eliminate the parentheses. This procedure is justified by the distributive property.

14. Francisco purchased x hot dogs and y hamburgers at a baseball game. He spent a total of $10. The equation below describes the relationship between the number of hot dogs and the number of hamburgers purchased.

$$3x + 4y = 10$$

The ordered pair (2, 1) is a solution of the equation. What does the solution (2, 1) represent?

A. Hamburgers cost 2 times as much as hot dogs.

B. Francisco purchased 2 hot dogs and 1 hamburger.

C. Hot dogs cost $2 each and hamburgers cost $1 each.

D. Francisco spent $2 on hot dogs and $1 on hamburgers.

15. Anna burned 15 calories per minute running for x minutes and 10 calories per minute hiking for y minutes. She spent a total of 60 minutes running and hiking and burned 700 calories. The system of equations shown below can be used to determine how much time Anna spent on each exercise.

$$15x + 10y = 700$$
$$x + y = 60$$

What is the value of x, the minutes Anna spent running?

A. 10

B. 20

C. 30

D. 40

16. Samantha and Maria purchased flowers. Samantha purchased 5 roses for x dollars each and 4 daisies for y dollars each and spent \$32 on the flowers. Maria purchased 1 rose for x dollars and 6 daisies for y dollars each and spent \$22. The system of equations shown below represents this situation.

$$5x + 4y = 32$$
$$x + 6y = 22$$

Which statement is true?

A. A rose costs \$1 more than a daisy.

B. Samantha spent \$4 on each daisy.

C. Samantha spent more on daisies than she did on roses.

D. Samantha spent over 4 times as much on daisies as she did on roses.

A1.1.3 Linear Inequalities

MOD 1

ASSESSMENT ANCHOR A1.1.3 Linear Inequalities		
Anchor Descriptor	**Eligible Content**	**PA Common Core Standards**
A1.1.3.1 Write, solve, and/or graph linear inequalities using various methods.	**A1.1.3.1.1** Write or solve compound inequalities and/or graph their solution sets on a number line (may include absolute value inequalities). **A1.1.3.1.2** Identify or graph the solution set to a linear inequality on a number line. **A1.1.3.1.3** Interpret solutions to problems in the context of the problem situation. Note: Limit to linear inequalities.	**CC.2.2.HS.D.7** Create and graph equations or inequalities to describe numbers or relationships. **CC.2.2.HS.D.9** Use reasoning to solve equations and justify the solution method. **CC.2.2.HS.D.10** Represent, solve and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically. **CC.2.1.HS.F.5** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
Anchor Descriptor	**Eligible Content**	**PA Common Core Standards**
A1.1.3.2 Write, solve, and/or graph systems of linear inequalities using various methods.	**A1.1.3.2.1** Write and/or solve a system of linear inequalities using graphing. Note: Limit systems to two linear inequalities. **A1.1.3.2.2** Interpret solutions to problems in the context of the problem situation. Note: Limit systems to two linear inequalities.	**CC.2.2.HS.D.10** Represent, solve and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically. **CC.2.1.HS.F.5** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

17. A compound inequality is shown below.

$$5 < 2 - 3y < 14$$

What is the solution of the compound inequality?

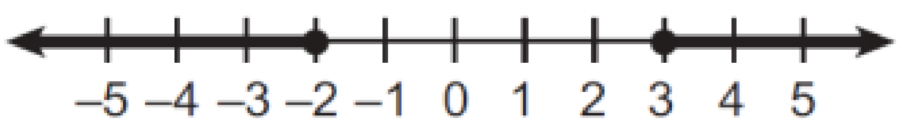
A. $-4 > y > -1$

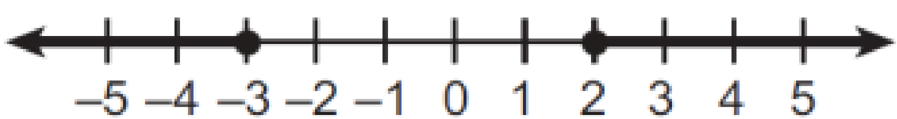
B. $-4 < y < -1$

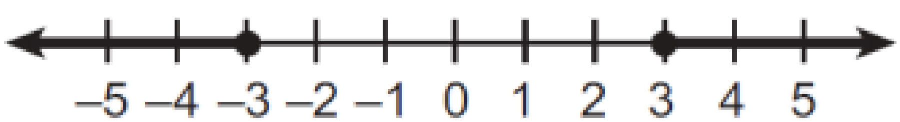
C. $1 > y > 4$

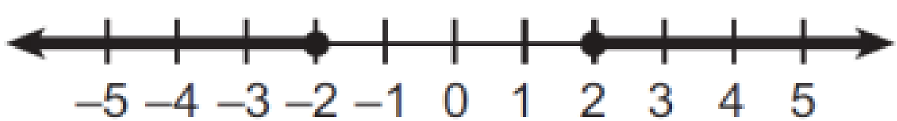
D. $1 < y < 4$

18. Which is a graph of the solution of the inequality $|\quad - \quad| \geq 5$?

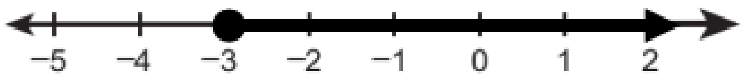
A.


B.


C.


D.


19. The solution set of an inequality is graphed on the number line below.



The graph shows the solution set of which inequality?

A. $2x + 5 < -1$

B. $2x + 5 \leq -1$

C. $2x + 5 > -1$

D. $2x + 5 \geq -1$

20. A baseball team had $1,000 to spend on supplies. The team spent $185 on a new bat. New baseballs cost $4 each. The inequality $185 + 4b \leq 1{,}000$ can be used to determine the number of new baseballs (b) that the team can purchase. Which statement about the number of new baseballs that can be purchased is true?

A. The team can purchase 204 new baseballs.

B. The minimum number of new baseballs that can be purchased is 185.

C. The maximum number of new baseballs that can be purchased is 185.

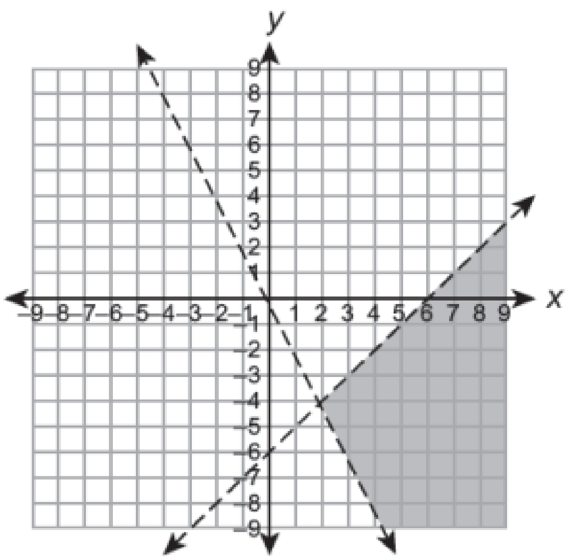
D. The team can purchase 185 new baseballs, but this number is neither the maximum nor the minimum.

21. A system of inequalities is shown below.

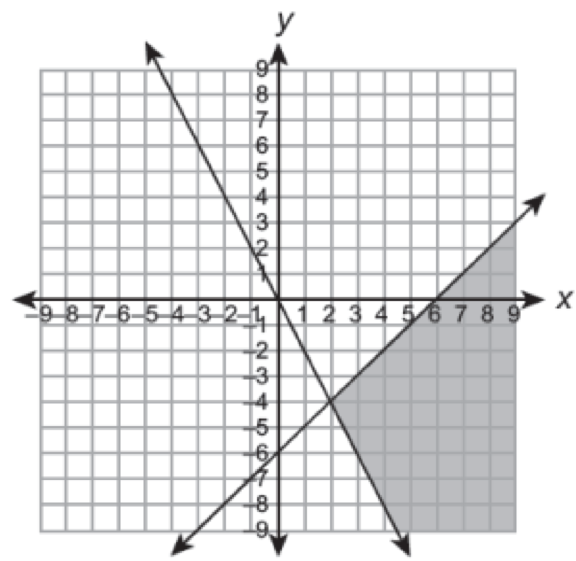
$$y < x - 6$$
$$y > -2x$$

Which graph shows the solution set of the system of inequalities?

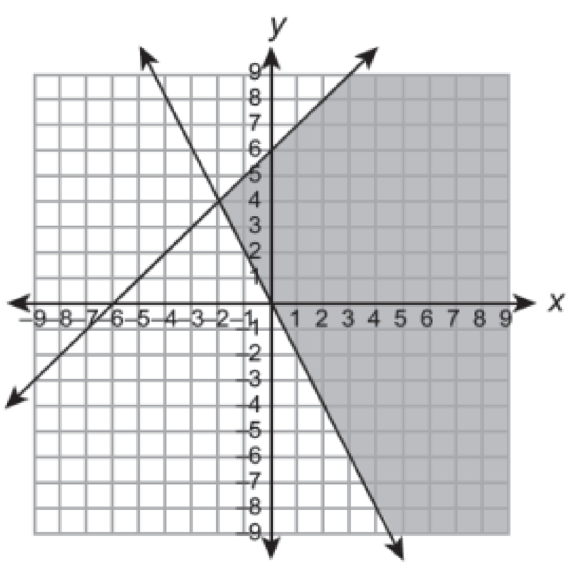
A.



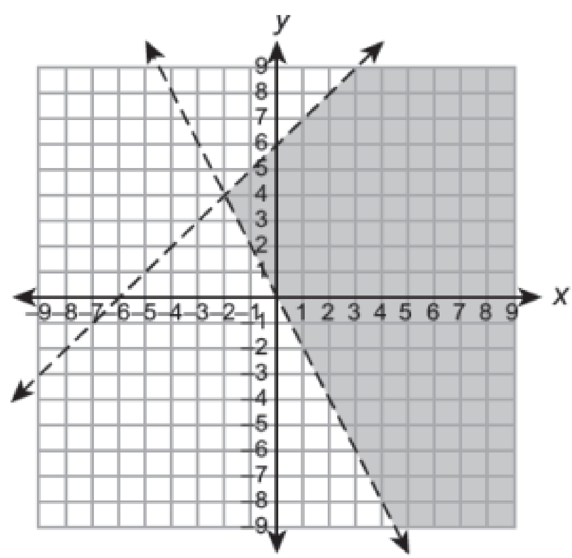
B.



C.



D.



22. Tyreke always leaves a tip of between 8% and 20% for the server when he pays for his dinner. This can be represented by the system of inequalities shown below, where y is the amount of tip and x is the cost of dinner.

$$y > 0.08x$$
$$y < 0.2x$$

Which of the following is a true statement?

A. When the cost of dinner (x) is \$10, the amount of tip (y) must be between \$2 and \$8.

B. When the cost of dinner (x) is \$15, the amount of tip (y) must be between \$1.20 and \$3.00.

C. When the amount of tip (y) is \$3, the cost of dinner (x) must be between \$11 and \$23.

D. When the amount of tip (y) is \$2.40, the cost of dinner (x) must be between \$3 and \$6.

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Module 2

Linear Functions & Data Organization

Rubric:

1 point for each correct answer: multiple choice.

A1.2.1 Functions

ASSESSMENT ANCHOR A1.2.1 Functions		
Anchor Descriptor	**Eligible Content**	**PA Common Core Standards**
A1.2.1.1 Analyze and/or use patterns or relations.	**A1.2.1.1.1** Analyze a set of data for the existence of a pattern and represent the pattern algebraically and/or graphically. **A1.2.1.1.2** Determine whether a relation is a function, given a set of points or a graph. **A1.2.1.1.3** Identify the domain or range of a relation (may be presented as ordered pairs, a graph, or a table).	**CC.2.2.HS.C.2** Graph and analyze functions and use their properties to make connections between the different representations. **CC.2.2.HS.C.1** Use the concept and notation of functions to interpret and apply them in terms of their context. **CC.2.2.HS.C.3** Write functions or sequences that model relationships between two quantities. **CC.2.4.HS.B.2** Summarize, represent, and interpret data on two categorical and quantitative variables.

Anchor Descriptor	Eligible Content	PA Common Core Standards
A1.2.1.2 Interpret and/or use linear functions and their equations, graphs, or tables.	**A1.2.1.2.1** Create, interpret, and/or use the equation, graph, or table of a linear function. **A1.2.1.2.2** Translate from one representation of a linear function to another (i.e., graph, table, and equation).	**CC.2.2.8.B.2** Understand the connections between proportional relationships, lines, and linear equations. **CC.2.4.HS.B.2** Summarize, represent, and interpret data on two categorical and quantitative variables. **CC.2.1.HS.F.3** Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs and data displays. **CC.2.1.HS.F.4** Use units as a way to understand problems and to guide the solution of multi-step problems. **CC.2.2.HS.C.2** Graph and analyze functions and use their properties to make connections between the different representations. **CC.2.2.HS.C.3** Write functions or sequences that model relationships between two quantities. **CC.2.2.HS.C.4** Interpret the effects transformations have on functions and find the inverses of functions. **CC.2.2.HS.C.6** Interpret functions in terms of the situation they model.

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23. Tim's scores the first 5 times he played a video game are listed below.

4,526 4,599 4,672 4,745 4,818

Tim's scores follow a pattern. Which expression can be used to determine his score after he played the video game n times?

A. $73n + 4{,}453$

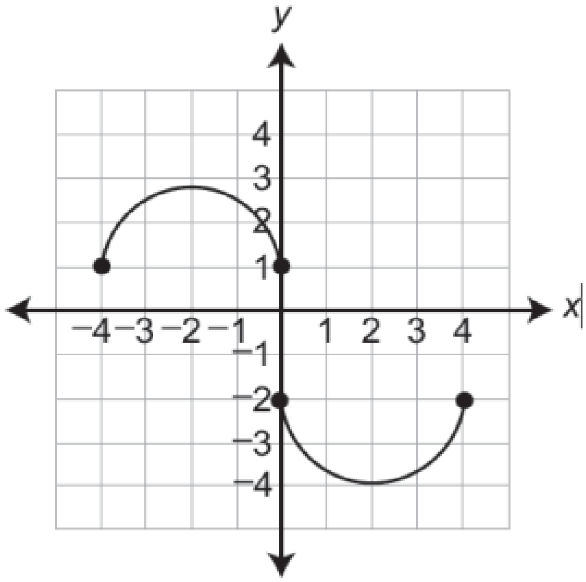
B. $73(n + 4{,}453)$

C. $4{,}453n + 73$

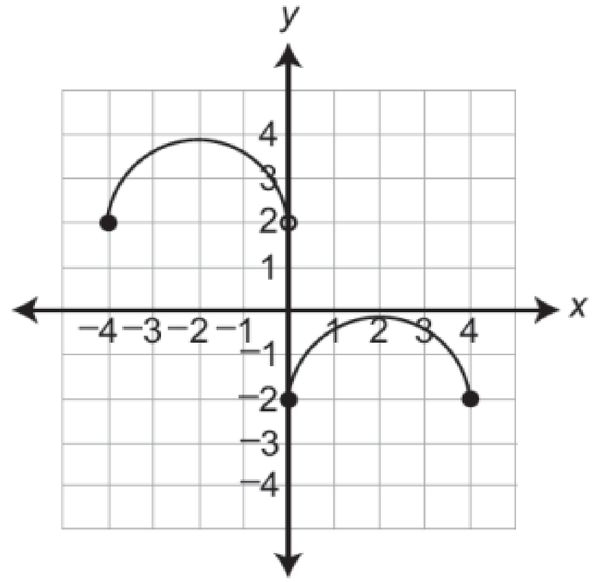
D. $4{,}526n$

24. Which graph shows y as a function of x?

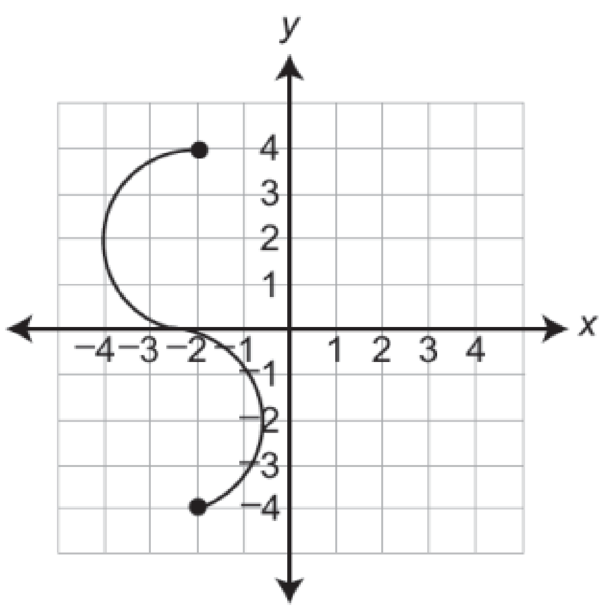
A.



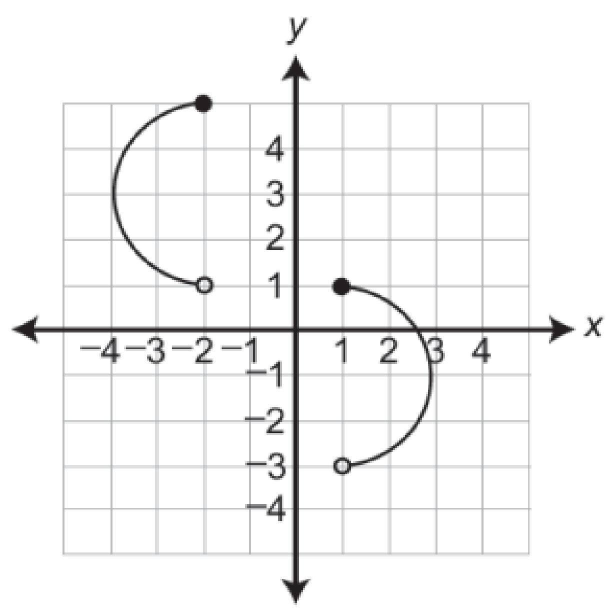
B.



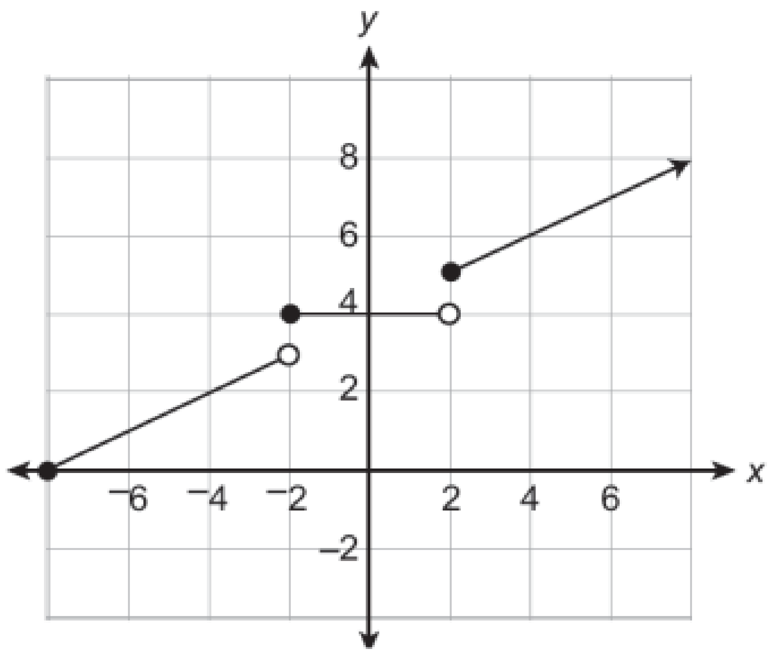
C.



D.



25. The graph of a function is shown below.



Which value is not in the range of the function?

A. 0

B. 3

C. 4

D. 5

26. A pizza restaurant charges for pizzas and adds a delivery fee. The cost (c), in dollars, to have any number of pizzas (p) delivered to a home is described by the function $c = 8p + 3$. Which statement is true?

A. The cost of 8 pizzas is $11.

B. The cost of 3 pizzas is $14.

C. Each pizza costs $8 and the delivery fee is $3.

D. Each pizza costs $3 and the delivery fee is $8.

M O D 2

27. The table below shows values of y as a function of x.

x	y
2	10
6	25
14	55
26	100
34	130

Which linear equation best describes the relationship between x and y?

A. $y = 2.5x + 5$

B. $y = 3.75x + 2.5$

C. $y = 4x + 1$

D. $y = 5x$

A1.2.2 Coordinate Geometry

M O D 2

ASSESSMENT ANCHOR **A1.2.2 Coordinate Geometry**		
Anchor Descriptor	**Eligible Content**	**PA Common Core Standards**
A1.2.2.1 Describe, compute, and/or use the rate of change (slope) of a line.	**A1.2.2.1.1** Identify, describe, and/or use constant rates of change. **A1.2.2.1.2** Apply the concept of linear rate of change (slope) to solve problems. **A1.2.2.1.3** Write or identify a linear equation when given • the graph of the line, • two points on the line, or • the slope and a point on the line. Note: Linear equation may be in point-slope, standard, and/or slope-intercept form. **A1.2.2.1.4** Determine the slope and/or y-intercept represented by a linear equation or graph.	**CC.2.2.8.C.1** Define, evaluate, and compare functions. **CC.2.2.8.C.2** Use concepts of functions to model relationships between quantities. **CC.2.2.HS.C.1** Use the concept and notation of functions to interpret and apply them in terms of their context. **CC.2.2.HS.C.3** Write functions or sequences that model relationships between two quantities. **CC.2.2.HS.C.5** Construct and compare linear, quadratic and/or exponential models to solve problems.
Anchor Descriptor	**Eligible Content**	**PA Common Core Standards**
A1.2.2.2 Analyze and/or interpret data on a scatter plot.	**A1.2.2.2.1** Draw, identify, find, and/or write an equation for a line of best fit for a scatter plot.	**CC.2.4.HS.B.2** Summarize, represent, and interpret data on two categorical and quantitative variables. **CC.2.4.HS.B.3** Analyze linear models to make interpretations based on the data. **CC.2.2.HS.C.6** Interpret functions in terms of the situation they model.

28. Jeff's restaurant sells hamburgers. The amount charged for a hamburger (h) is based on the cost for a plain hamburger plus an additional charge for each topping (t) as shown in the equation below.

$$h = 0.60t + 5$$

What does the number 0.60 represent in the equation?

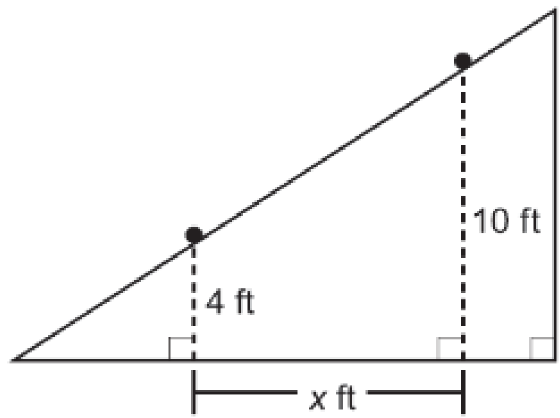
A. the number of toppings

B. the cost of a plain hamburger

C. the additional cost for each topping

D. the cost of a hamburger with 1 topping

29. A ball rolls down a ramp with a slope of –. At one point the ball is 10 feet high, and at another point the ball is 4 feet high, as shown in the diagram below.



What is the horizontal distance (*x*), in feet, the ball traveled as it rolled down the ramp from 10 feet high to 4 feet high?

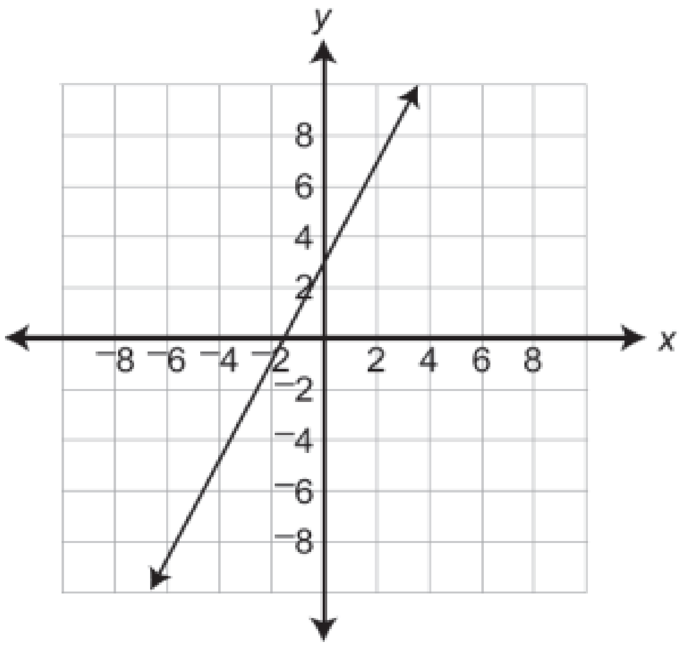
A. 6

B. 9

C. 14

D. 15

30. A graph of a linear equation is shown below.



Which equation describes the graph?

A. $y = 0.5x - 1.5$

B. $y = 0.5x + 3$

C. $y = 2x - 1.5$

D. $y = 2x + 3$

MOD 2

MOD 2

31. A juice machine dispenses the same amount of juice into a cup each time the machine is used. The equation below describes the relationship between the number of cups (x) into which juice is dispensed and the gallons of juice (y) remaining in the machine.

$$x + 12y = 180$$

How many gallons of juice are in the machine when it is full?

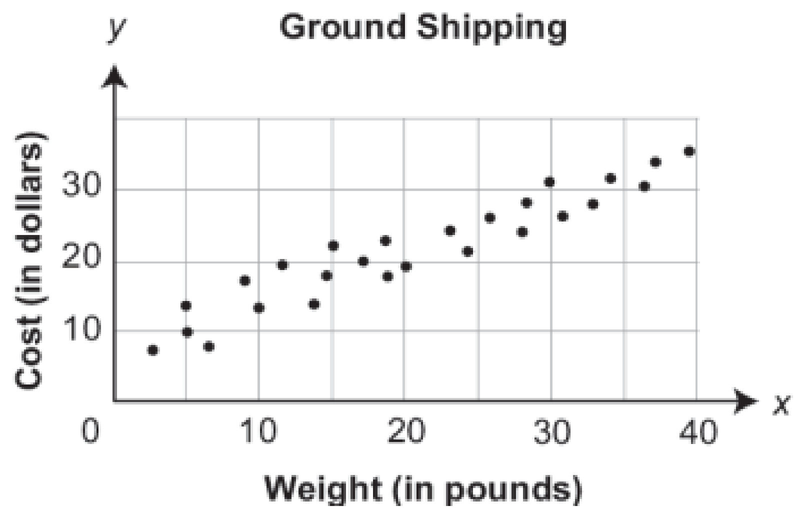
A. 12

B. 15

C. 168

D. 180

32. The scatter plot below shows the cost (y) of ground shipping packages from Harrisburg, PA, to Minneapolis, MN, based on the package weight (x).



Which equation best describes the line of best fit?

A. $y = 0.37x + 1.57$

B. $y = 0.37x + 10.11$

C. $y = 0.68x + 2.32$

D. $y = 0.68x + 6.61$

MOD 2

M
O
D

2

A1.2.3 Data Analysis

ASSESSMENT ANCHOR A1.2.3 Data Analysis		
Anchor Descriptor	**Eligible Content**	**PA Common Core Standards**
A1.2.3.1 Use measures of dispersion to describe a set of data.	**A1.2.3.1.1** Calculate and/or interpret the range, quartiles, and interquartile range of data.	**CC.2.4.HS.B.1** Summarize, represent, and interpret data on a single count or measurement variable. **CC.2.4.HS.B.3** Analyze linear models to make interpretations based on the data.
Anchor Descriptor	**Eligible Content**	**PA Common Core Standards**
A1.2.3.2 Use data displays in problem-solving settings and/or to make predictions.	**A1.2.3.2.1** Estimate or calculate to make predictions based on a circle, line, bar graph, measures of central tendency, or other representations.	**CC.2.4.HS.B.1** Summarize, represent, and interpret data on a single count or measurement variable. **CC.2.4.HS.B.3** Analyze linear models to make interpretations based on the data. **CC.2.4.HS.B.5** Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.
	A1.2.3.2.2 Analyze data, make predictions, and/or answer questions based on displayed data (box-and-whisker plots, stem-and-leaf plots, scatter plots, measures of central tendency, or other representations).	
	A1.2.3.2.3 Make predictions using the equations or graphs of best-fit lines of scatter plots.	
Anchor Descriptor	**Eligible Content**	**PA Common Core Standards**
A1.2.3.3 Apply probability to practical situations.	**A1.2.3.3.1** Find probabilities for compound events (e.g., find probability of red and blue, find probability of red or blue) and represent as a fraction, decimal, or percent.	**CC.2.4.HS.B.4** Recognize and evaluate random processes underlying statistical experiments. **CC.2.4.HS.B.7** Apply the rules of probability to compute probabilities of compound events in a uniform probability model.

33. The daily high temperatures, in degrees Fahrenheit (°F), of a town are recorded for one year. The median high temperature is 62°F. The interquartile range of high temperatures is 32.

Which is most likely to be true?

A. Approximately 25% of the days had a high temperature less than 30°F.

B. Approximately 25% of the days had a high temperature greater than 62°F.

C. Approximately 50% of the days had a high temperature greater than 62°F.

D. Approximately 75% of the days had a high temperature less than 94°F.

34. The daily high temperatures in degrees Fahrenheit in Allentown, PA, for a period of 10 days are shown below.

76 80 89 96 98 100 98 91 89 82

Which statement correctly describes the data?

A. The median value is 98.

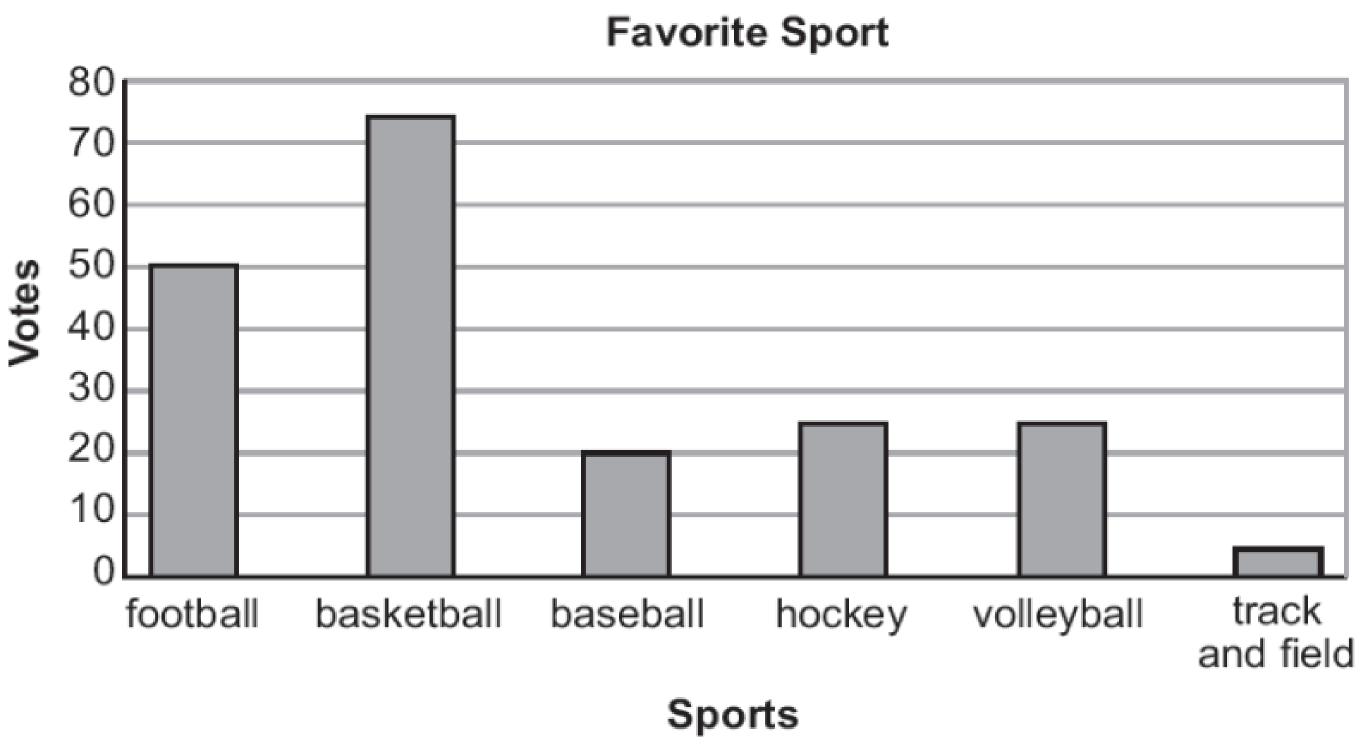
B. The interquartile range is 16.

C. The lower quartile value is 76.

D. The upper quartile value is 96.

M O D 2

35. Vy asked 200 students to select their favorite sport and then recorded the results in the bar graph below.



Vy will ask another 80 students to select their favorite sport. Based on the information in the bar graph, how many more students of the next 80 asked will select basketball rather than football as their favorite sport?

A. 10

B. 20

C. 25

D. 30

36. The points scored by a football team are shown in the stem-and-leaf plot below.

Football Team Points

0	6							
1	2	3	4	7				
2	0	3	4	4	7	8	8	8
3	0	7	8					

Key
1 | 3 = 13 points

What was the median number of points scored by the football team?

A. 24

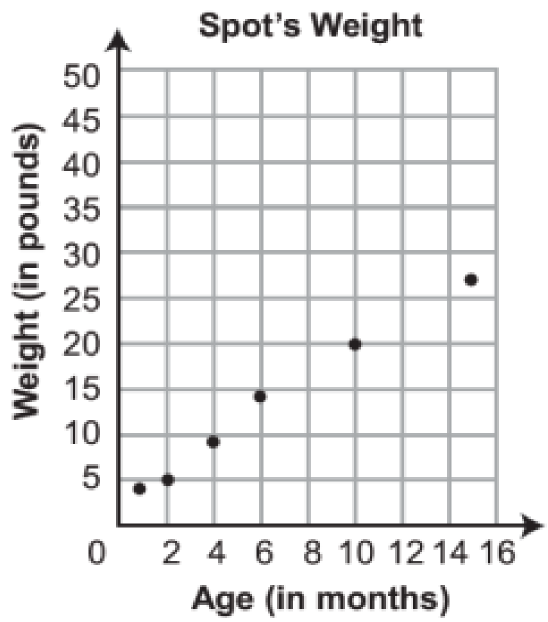
B. 27

C. 28

D. 32

MOD 2

37. John recorded the weight of his dog Spot at different ages as shown in the scatter plot below.



Based on the line of best fit, what will be Spot's weight after 18 months?

A. 27 pounds

B. 32 pounds

C. 36 pounds

D. 50 pounds

24. A number cube with sides labeled 1 through 6 is rolled two times, and the sum of the numbers that end face up is calculated. What is the probability that the sum of the numbers is 3?

A. —

B. —

C. –

D. –

Constructed Response

Fill In the Blank
A1.1.1 to A1.2.3

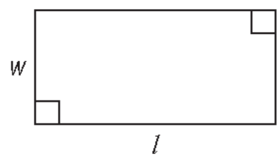
Rubric:

1 point for each correct answer.

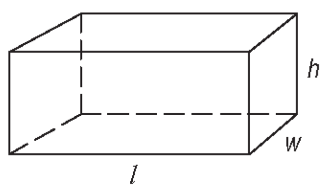
- **Units** are usually **supplied** for the student.
- **Answer** is usually a **number**, **equation** or **description**

ALGEBRA I FORMULA SHEET

Formulas that you may need to solve questions on this exam are found below.
You may use calculator π or the number 3.14.



$A = lw$



$V = lwh$

Linear Equations

Slope: $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

Point-Slope Formula: $(y - y_1) = m(x - x_1)$

Slope-Intercept Formula: $y = mx + b$

Standard Equation of a Line: $Ax + By = C$

Arithmetic Properties

Additive Inverse: $a + (^-a) = 0$

Multiplicative Inverse: $a \cdot \dfrac{1}{a} = 1$

Commutative Property: $a + b = b + a$
$a \cdot b = b \cdot a$

Associative Property: $(a + b) + c = a + (b + c)$
$(a \cdot b) \cdot c = a \cdot (b \cdot c)$

Identity Property: $a + 0 = a$
$a \cdot 1 = a$

Distributive Property: $a \cdot (b + c) = a \cdot b + a \cdot c$

Multiplicative Property of Zero: $a \cdot 0 = 0$

Additive Property of Equality:
If $a = b$, then $a + c = b + c$

Multiplicative Property of Equality:
If $a = b$, then $a \cdot c = b \cdot c$

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Standard A1.1.1

The results of an experiment were listed in several numerical forms as listed below.

$$5^{-3} \qquad \frac{4}{7} \qquad \sqrt{5} \qquad \frac{3}{8} \qquad 0.003$$

A. Order the numbers listed from **least** to **greatest**.

________ ________ ________ ________ ________

Constructed Response

Another experiment required evaluating the expression shown below.

$$\frac{1}{6}\left(\sqrt{36} \div 3^{-2}\right) + 4^3 \div |{}^{-}8|$$

B. What is the value of the expression?

value of the expression: ____________________

Continued next page

Constructed Response

Continued. Please refer to the previous page for task explanation.

The last experiment required simplifying $7\sqrt{425}$. The steps taken are shown below.

$$7\sqrt{425}$$

step 1: $7\left(\sqrt{400} + \sqrt{25}\right)$

step 2: $7(20 + 5)$

step 3: $7(25)$

step 4: 175

One of the steps shown is incorrect.

C. Rewrite the incorrect step so that it is correct.

correction: ______________________________

D. Using the corrected step from **part C**, simplify $7\sqrt{425}$.

$7\sqrt{425}$ = ______________________________

ASSESSMENT ANCHOR
A1.1.2 Linear Equations

Sample Exam Questions

Standard A1.1.2

Nolan has \$15.00, and he earns \$6.00 an hour babysitting. The equation below can be used to determine how much money in dollars (m) Nolan has after any number of hours of babysitting (h).

$$m = 6h + 15$$

A. After how many hours of babysitting will Nolan have \$51.00?

hours: ____________________

Constructed Response

Claire has \$9.00. She makes \$8.00 an hour babysitting.

B. Use the system of linear equations below to find the number of hours of babysitting after which Nolan and Claire will have the same amount of money.

$$m = 6h + 15$$

$$m = 8h + 9$$

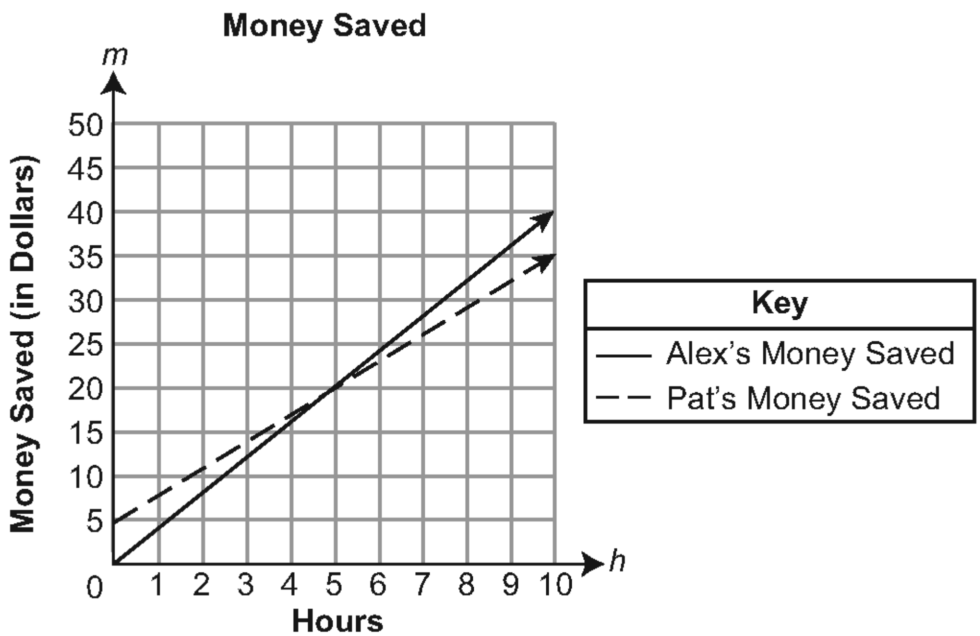
hours: ____________________

Continued next page

Constructed Response

Continued. Please refer to the previous page for task explanation.

The graph below displays the amount of money Alex and Pat will each have saved after their hours of babysitting.

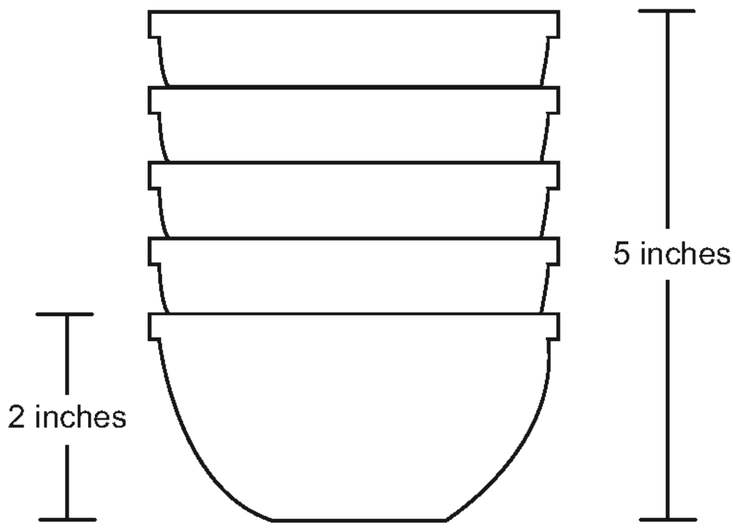


C. Based on the graph, for what domain (h) will Alex have more money saved than Pat? Explain your reasoning.

Standard A1.1.2

The diagram below shows 5 identical bowls stacked one inside the other.

Bowls



The height of 1 bowl is 2 inches. The height of a stack of 5 bowls is 5 inches.

A. Write an equation using *x* and *y* to find the height of a stack of bowls based on any number of bowls.

equation: ____________________________

Continued next page

Constructed Response

Continued. Please refer to the previous page for task explanation.

B. Describe what the x and y variables represent.

x-variable: ______________________________

y-variable: ______________________________

C. What is the height, in inches, of a stack of 10 bowls?

height: ______________________________ inches

ASSESSMENT ANCHOR	
A1.1.3	Linear Inequalities

Sample Exam Questions

Standard A1.1.3

An apple farm owner is deciding how to use each day's harvest. She can use the harvest to produce apple juice or apple butter. The information she uses to make the decision is listed below.

- A bushel of apples will make 16 quarts of apple juice.
- A bushel of apples will make 20 pints of apple butter.
- The apple farm can produce **no more than** 180 pints of apple butter each day.
- The apple farm harvests **no more than** 15 bushels of apples each day.

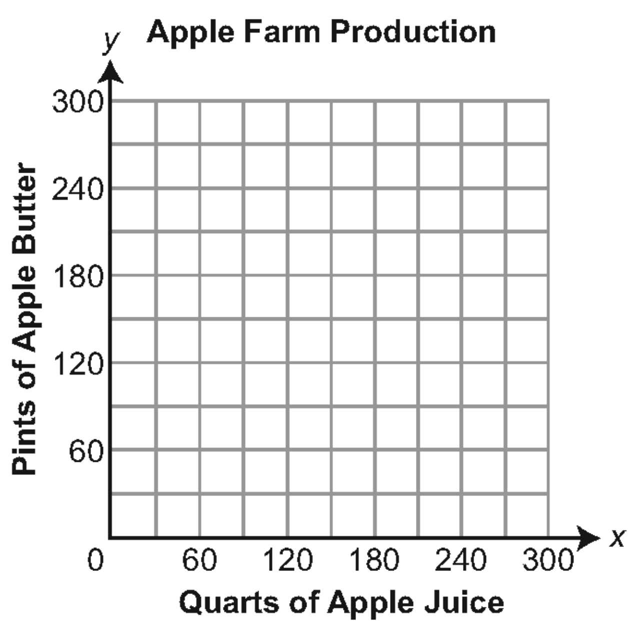
Constructed Response

The information given can be modeled with a system of inequalities. When x is the number of quarts of apple juice and y is number of pints of apple butter, two of the inequalities that model the situation are $x \geq 0$ and $y \geq 0$.

A. Write 2 more inequalities to complete the system of inequalities modeling the information.

inequalities: ______________________ ______________________

B. Graph the solution set of the inequalities from **part A** below. Shade the area that represents the solution set.



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Continued. Please refer to the previous page for task explanation.

The apple farm makes a profit of \$2.25 on each pint of apple butter and \$2.50 on each quart of apple juice.

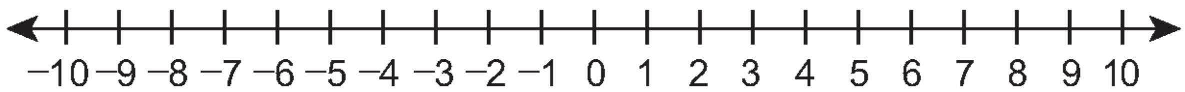
C. Explain how you can be certain the maximum profit will be realized when the apple farm produces 96 quarts of apple juice and 180 pints of apple butter.

Standard A1.1.3

David is solving problems with inequalities.

One of David's problems is to graph the solution set of an inequality.

A. Graph the solution set to the inequality $4x + 3 < 7x - 9$ on the number line below.



David correctly graphed an inequality as shown below.

The inequality David graphed was written in the form $7 \leq$ __?__ ≤ 9.

B. What is an expression that could be put in place of the question mark so that the inequality would have the same solution set as shown in the graph?

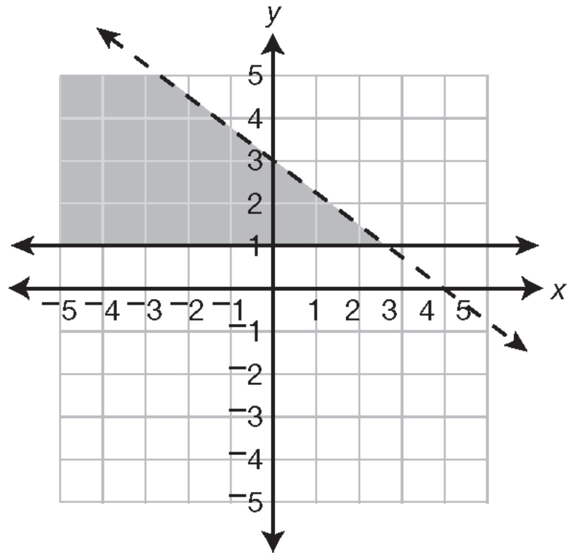
$7 \leq$ ____________ ≤ 9

Continued next page

Constructed Response

Continued. Please refer to the previous page for task explanation.

The solution set to a system of linear inequalities is graphed below.



C. Write a system of 2 linear inequalities which would have the solution set shown in the graph.

linear inequality 1: ____________________

linear inequality 2: ____________________

MODULE 2—Linear Functions and Data Organizations

ASSESSMENT ANCHOR
A1.2.1 Functions

Sample Exam Questions

Standard A1.2.1

Hector's family is on a car trip.

When they are 84 miles from home, Hector begins recording their distance driven (*d*), in miles, after *h* hours in the table below.

Distance by Hour

Time in Hours (*h*)	Distance in Miles (*d*)
0	84
1	146
2	208
3	270

The pattern continues.

A. Write an equation to find the distance driven (*d*), in miles, after a given number of hours (*h*).

Constructed Response

Continued next page

MODULE 2—Linear Functions and Data Organizations

Constructed Response

Continued. Please refer to the previous page for task explanation.

B. Hector also kept track of the remaining gasoline. The equation shown below can be used to find the gallons of gasoline remaining (g) after distance driven (d), in miles.

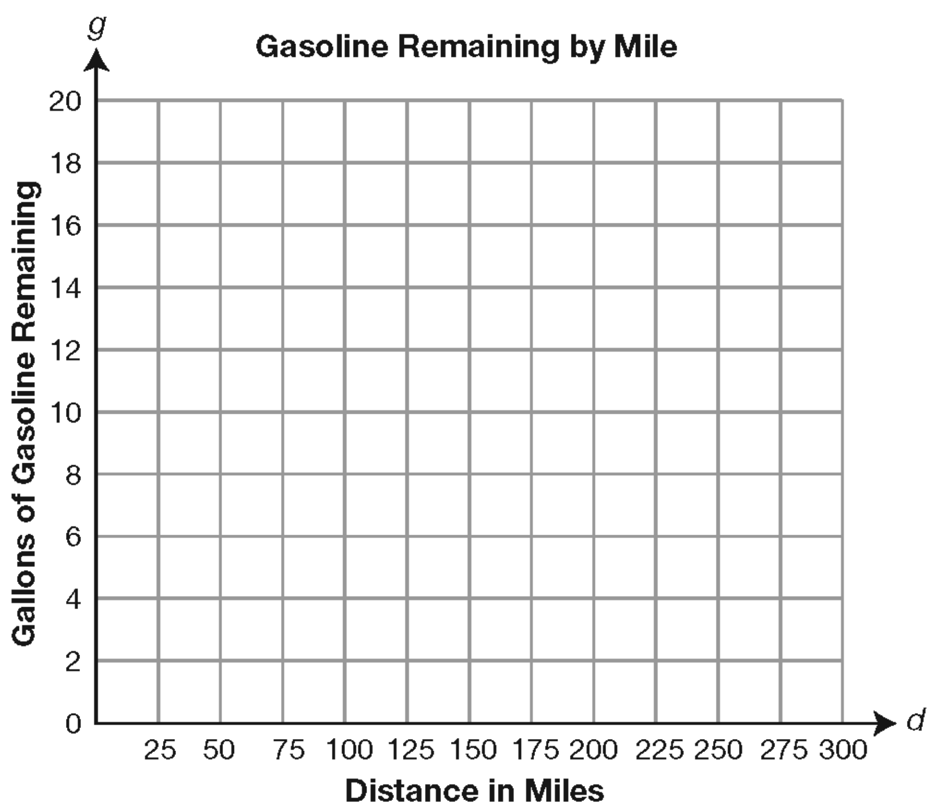
$$g = 16 - \frac{1}{20}d$$

Use the equation to find the missing values for gallons of gasoline remaining.

Gasoline Remaining by Mile

Distance in Miles (d)	Gallons of Gasoline Remaining (g)
100	
200	
300	

C. Draw the graph of the line formed by the points in the table from **part B**.



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Continued. Please refer to the previous page for task explanation.

D. Explain why the slope of the line drawn in **part C** must be negative.

MODULE 2—Linear Functions and Data Organizations

Standard A1.2.1

C o n s t r u c t e d R e s p o n s e

Last summer Ben purchased materials to build model airplanes and then sold the finished models. He sold each model for the same amount of money. The table below shows the relationship between the number of model airplanes sold and the running total of Ben's profit.

Ben's Model Airplane Sales

Model Airplanes Sold	Total Profit
12	$68
15	$140
20	$260
22	$308

A. Write a linear equation, in slope-intercept form, to represent the amount of Ben's total profit (y) based on the number of model airplanes (x) he sold.

y = ______________________

B. How much did Ben spend on his model-building materials?

$ ______________________

Continued next page

Continued. Please refer to the previous page for task explanation.

C. What is the fewest number of model airplanes Ben needed to sell in order to make a profit?

fewest number: ______________________

D. What is a reasonable value in the range that would be a negative number?

range value: ______________________

MODULE 2—Linear Functions and Data Organizations

ASSESSMENT ANCHOR
A1.2.2 Coordinate Geometry

Sample Exam Questions

Standard A1.2.2

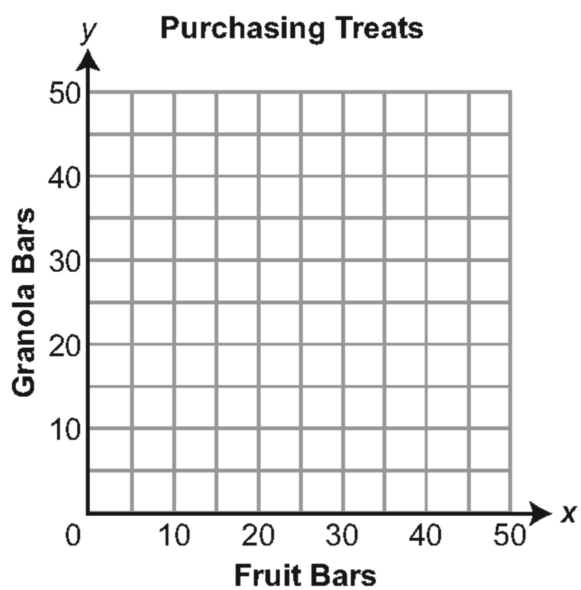
Georgia is purchasing treats for her classmates. Georgia can spend exactly $10.00 to purchase 25 fruit bars, each equal in price. Georgia can also spend exactly $10.00 to purchase 40 granola bars, each equal in price.

Constructed Response

A. Write an equation which can be used to find all combinations of fruit bars (x) and granola bars (y) that will cost exactly $10.00.

equation: ______________________

B. Graph the equation from **part A** below.



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Continued. Please refer to the previous page for task explanation.

C. What is the slope of the line graphed in **part B**?

slope: ______________________________

D. Explain what the slope from **part C** means in the context of Georgia purchasing treats.

MODULE 2—Linear Functions and Data Organizations

Standard A1.2.2

Constructed Response

Ahava is traveling on a train.

The train is going at a constant speed of 80 miles per hour.

A. How many hours will it take for the train to travel 1,120 miles?

hours: ____________________

Ahava also considered taking an airplane. The airplane can travel the same 1,120 miles in 12 hours less time than the train.

B. What is the speed of the airplane in miles per hour (mph)?

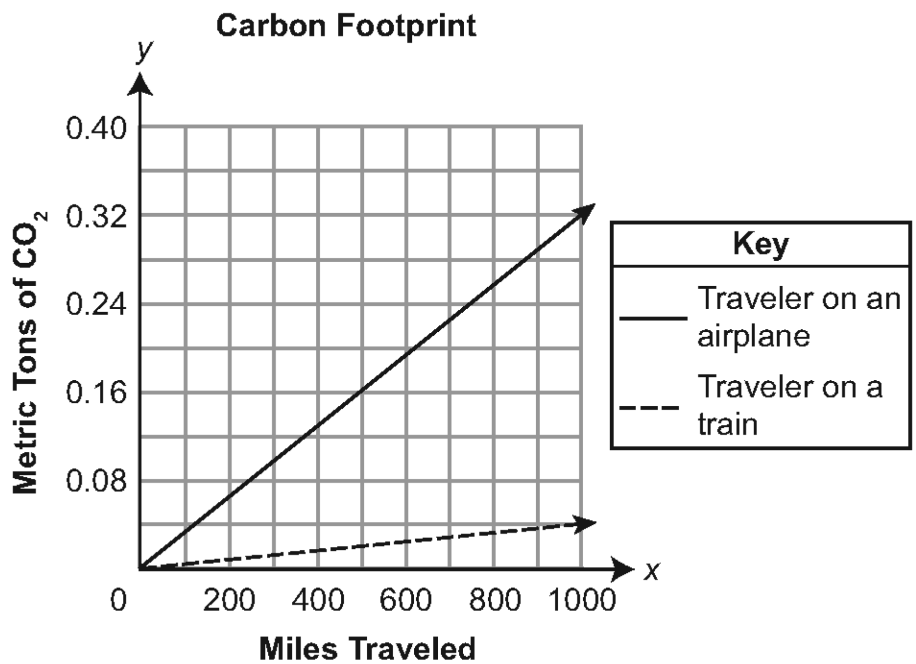
speed of the airplaine: ____________________ mph

Continued next page

MODULE 2—Linear Functions and Data Organizations

Continued. Please refer to the previous page for task explanation.

Ahava is very concerned about the environment. The graph below displays the carbon dioxide (CO_2), in metric tons, for each traveler on an airplane and each traveler on a train.



C. What is the equation to find the metric tons of CO_2 produced (y) by a traveler on an airplane for miles traveled (x)?

equation: ______________________________

Continued next page

Constructed Response

Continued. Please refer to the previous page for task explanation.

On another trip, Ahava traveled to her destination on a train and returned home on an airplane. Her total carbon footprint for the trip was 0.42 metric tons of CO_2 produced.

D. How far, in miles, is Ahava's destination from her home?

miles: ______________________

MODULE 2—Linear Functions and Data Organizations

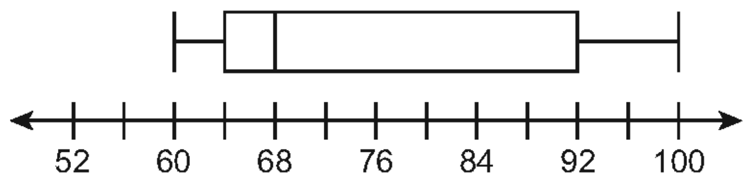
ASSESSMENT ANCHOR
A1.2.3 Data Analysis

Sample Exam Questions

Standard A1.2.3

The box-and-whisker plot shown below represents students' test scores on Mr. Ali's history test.

History Test Scores



A. What is the range of scores for the history test?

range: ______________________________

B. What is the **best** estimate for the percent of students scoring greater than 92 on the test?

percent: ______________________________ %

Continued next page

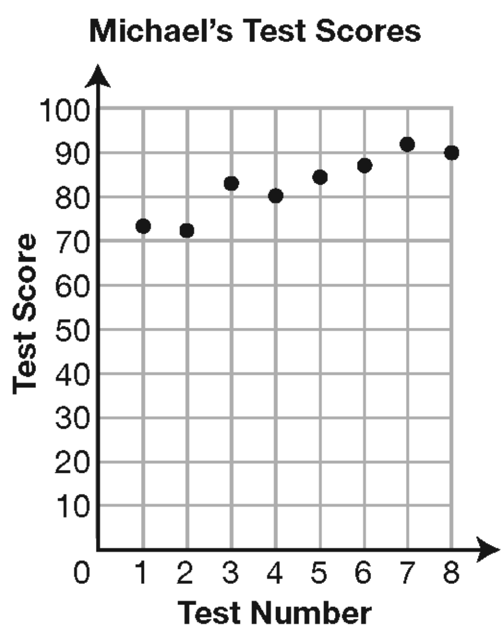
Constructed Response

Continued. Please refer to the previous page for task explanation.

Mr. Ali wanted more than half of the students to score 75 or greater on the test.

C. Explain how you know that more than half of the students did **not** score greater than 75.

Michael is a student in Mr. Ali's class. The scatter plot below shows Michael's test scores for each test given by Mr. Ali.



D. Draw a line of best fit on the scatter plot above.

MODULE 2—Linear Functions and Data Organizations

Standard A1.2.3

The weight, in pounds, of each wrestler on the high school wrestling team at the beginning of the season is listed below.

178 142 112 150 206 130

A. What is the median weight of the wrestlers?

median: ______________ pounds

B. What is the mean weight of the wrestlers?

mean: ______________ pounds

Constructed Response

Continued next page

Continued. Please refer to the previous page for task explanation.

Two more wrestlers join the team during the season. The addition of these wrestlers has no effect on the mean weight of the wrestlers, but the median weight of the wrestlers increases 3 pounds.

C. Determine the weights of the two new wrestlers.

new wrestlers: ______________ pounds and ______________ pounds

Constructed Response

Mod 1: Writing Practice
A1.1.1

C
R

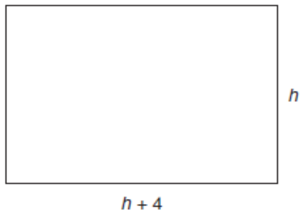
2

Rubric: [4 points]

- **1 point** for correct answers in the box.
- **1 additional point for correct description,** when prompted.

A1.1.1 Response Score: 4 points

11. Keng creates a painting on a rectangular canvas with a width that is four inches longer than the height, as shown in the diagram below.



A. Write a polynomial expression, in simplified form, that represents the area of the canvas.

$A = lw = (h+4)(h) = \underline{h^2 + 4h}$

1 Point

Student has given a correct expression.

What's the main idea?
A = L x W

Keng adds a 3-inch-wide frame around all sides of his canvas.

B. Write a polynomial expression, in simplified form, that represents the **total area** of the canvas and the frame.

$lw = (h+4+3+3)(h+3+3) = (h+10)(h+6)$

$= h^2 + 10h + 6h + 60 = \underline{h^2 + 16h + 60}$

1 Point

Student has given a correct expression.

Draw the 3" frame:

C R 2

11. ***Continued.*** Please refer to the previous page for task explanation.

Keng is unhappy with his 3-inch-wide frame, so he decides to put a frame with a different width around his canvas. The total area of the canvas and the new frame is given by the polynomial $h^2 + 8h + 12$, where h represents the height of the canvas.

C. Determine the width of the new frame. Show all your work. Explain why you did each step.

$\begin{array}{ccc} A & = & l \quad w \\ h^2 + 8h + 12 & = & (h+6)(h+2) \end{array}$ to find length + width from new area

What's the main idea?
A = L x W

Why am I doing this step?

$h+6-(h+4)$

$h+6-h-4 = 2''$

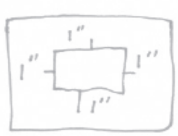
to find how much longer new length is on both sides of frame (same for width)

1 Point

Why am I doing this step?

$h+2-h = 2''$

1 Point



If 2 inches, then it's 1 inch on each side for new frame

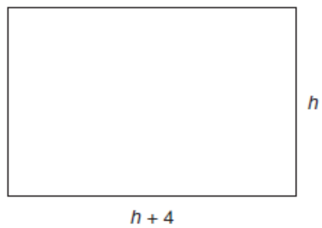
What does the answer mean to the average person?

Student has given a correct answer.
Student has shown work.
Student has given an explanation.

Based on Scoring Guidelines, 4 points is representative of a "thorough understanding."

A1.1.1 Response Score: 4 points

11. Keng creates a painting on a rectangular canvas with a width that is four inches longer than the height, as shown in the diagram below.



A. Write a polynomial expression, in simplified form, that represents the area of the canvas.

What's the main idea?

Keng adds a 3-inch-wide frame around all sides of his canvas.

B. Write a polynomial expression, in simplified form, that represents the **total area** of the canvas and the frame.

Draw the 3" frame:

C
R
2

11. ***Continued.*** Please refer to the previous page for task explanation.

Keng is unhappy with his 3-inch-wide frame, so he decides to put a frame with a different width around his canvas. The total area of the canvas and the new frame is given by the polynomial $h^2 + 8h + 12$, where h represents the height of the canvas.

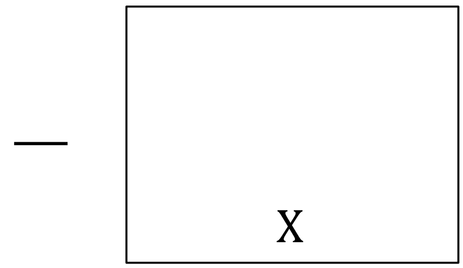
C. Determine the width of the new frame. Show all your work. Explain why you did each step.

What's the main idea?

Why am I doing this step?

What does the answer mean to the average person?

EX: Shalamar made a print in art class from ink, paint, carved blocks and objects from nature. Paper sizes in art class always have one side with a length that is 17/22 of the longer side.



A: Write a polynomial expression, in simplified form, which represents the area of the paper.

What's the main idea?

B: Shalamar wants to make a poster out of her art work. From experience, she knows that it is best not to reprint this type of art more than 4 times larger, as measured by area. Write expressions, in simplified form, which represent the lengths and widths of the largest poster size that Shalamar may print, given the length of an original side, X. [Note: Art reprints remain proportionate in size to the original.]

C R 2

What's the main idea?

Why am I doing this step?

Why am I doing this step?

What does the answer mean to the average person?

C: The poster is too big for the marquis in the school hallway. So, Shalamar makes another poster which is only 2 ¼ times larger than the original. What are the new dimensions? [Note: Art reprints remain proportionate in size to the original.]

Show all your work. Explain why you did each step.

What's the main idea?

Why am I doing this step?

C
R

2

Why am I doing this step?

What does the answer mean to the average person?

Constructed Response

Mod 2: Writing Practice
A1.2.1

C
R

2

Rubric: [4 points]

- **1 point** for correct answers in the box.
- **1 point** for a correct graph [2 points and line]
- **1 additional point for correct description,** when prompted.

Let's look at the correct way to answer a constructed response:

11. Hector's family is on a car trip.

When they are 84 miles from home, Hector begins recording their distance driven each hour in the table below.

Distance by Hour

Time in Hours	Distance in Miles
0	84
1	146
2	208
3	270

The pattern continues.

A. Write an equation to find distance driven in miles (*d*) after a given number of hours (*h*).

$d = 62h + 84$

Student has given a correct equation.

C
R

2

B. Hector also kept track of the remaining gasoline. The equation shown below can be used to find the gallons of gasoline remaining (*g*) after distance driven (*d*).

$$g = 16 - \frac{1}{20}d$$

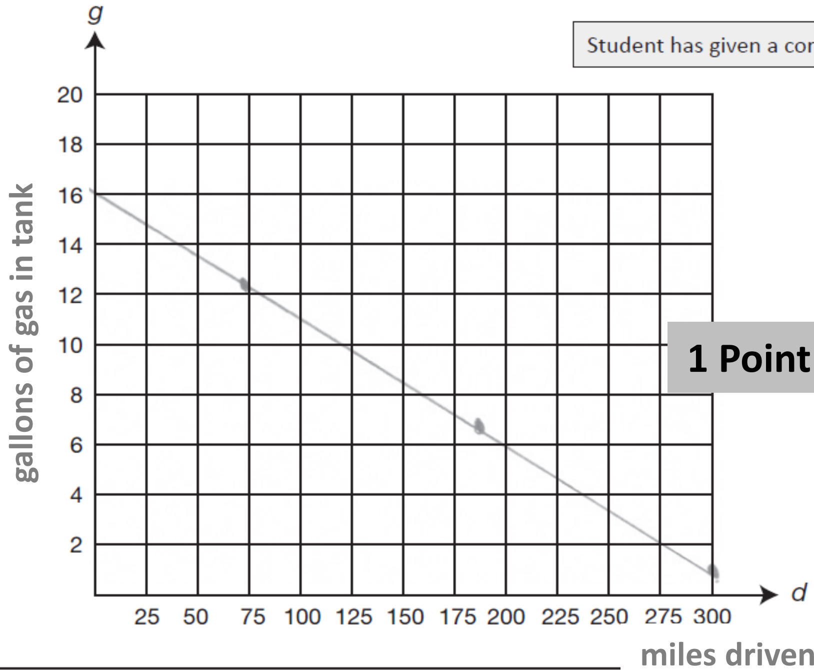
Use the equation to find the missing values for gallons of gasoline remaining.

Distance Driven in Miles (d)	Gallons of Gasoline Remaining (g)
100	11
200	6
300	1

Student has given correct values.

A1.2.1 Response Score

C. Draw the graph of the line formed by the points in the table from **part B**.



Student has given a correct graph.

1 Point

Explain:

1 Is slope **negative** or **positive**?
2 Which quantity is **increasing**?
3 Which quantity is **decreasing**?
4 What does this **mean** to the average person?

C
R
2

D. Explain why the slope of the line drawn in **part C** must be negative.

3

Gasoline will always be decreasing as miles driven increases.

2

This is a bare minimum explanation – notice that it does not explain that the
1 slope is **negative** or restate the meaning like, "You burn up gas as you drive." 4

1 Point

Now, rewrite the explanation. Use your own words and explain all 4 points above:

Student has given a correct explanation.

Now, trade papers with a partner. Circle and number all 4 explanation points from above. Add what they missed.

Let's try this same problem again, now that we've practiced:

Standard A1.2.1

Hector's family is on a car trip.

When they are 84 miles from home, Hector begins recording their distance driven (d), in miles, after h hours in the table below.

Distance by Hour

Time in Hours (h)	Distance in Miles (d)
0	84
1	146
2	208
3	270

The pattern continues.

A. Write an equation to find the distance driven (d), in miles, after a given number of hours (h).

C
R
2

B. Hector also kept track of the remaining gasoline. The equation shown below can be used to find the gallons of gasoline remaining (g) after distance driven (d), in miles.

$$g = 16 - \frac{1}{20}d$$

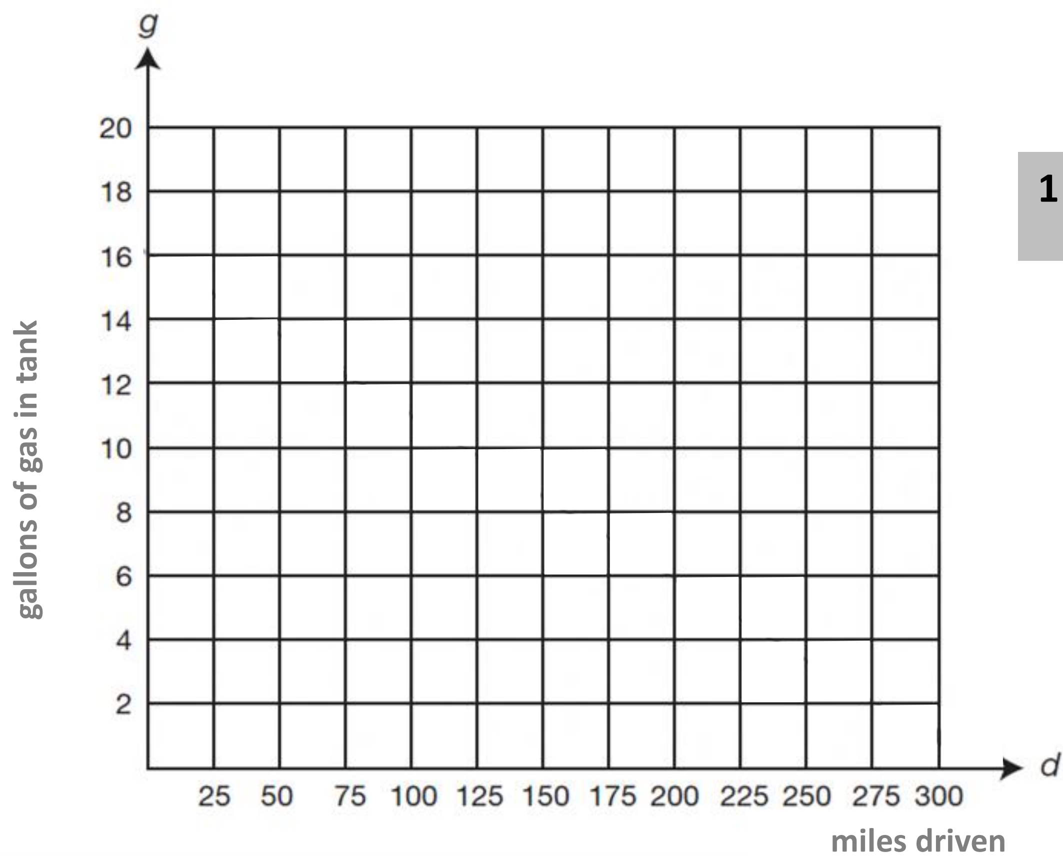
Use the equation to find the missing values for gallons of gasoline remaining.

Gasoline Remaining by Mile

Distance in Miles (d)	Gallons of Gasoline Remaining (g)
100	
200	
300	

A1.2.1 Response Score

C. Draw the graph of the line formed by the points in the table from **part B**.



1 Point

C
R

2

Explain:

1. Is slope **negative** or **positive**?
2. Which quantity is **increasing**?
3. Which quantity is **decreasing**?
4. What does this **mean** to the average person**?**

D. Explain why the slope of the line drawn in **part C** must be negative.

1 Point

Now, trade papers with a partner. Circle and number all 4 explanation points from above. Add what they missed.

EX: Buttercup has a fairly constant amount of time it takes for her to get into her car from a house, start the car and then later to walk to her workstation from her car.

A: When Buttercup drives to work, she spends 3 minutes getting into her car from her house, 2 minutes starting her car and 5 minutes walking to her work station. If her average speed is 30 miles per hour, then how long will it take Buttercup to get to her workstation if she lives 10 miles from work? Show all your work . Explain why you did each step.

What's the main idea?

Why am I doing this step?

B: Sometimes Buttercup visits a friend or goes shopping before work. Write an equation, in simplified form, that represents Buttercup's travel time (t) to work based upon the distance (d) she must travel. Assume the time to get into and start her car, as well as walk to her work station remain the same as in Part A. Show all your work . Explain why you did each step.

C
R

2

What's the main idea?

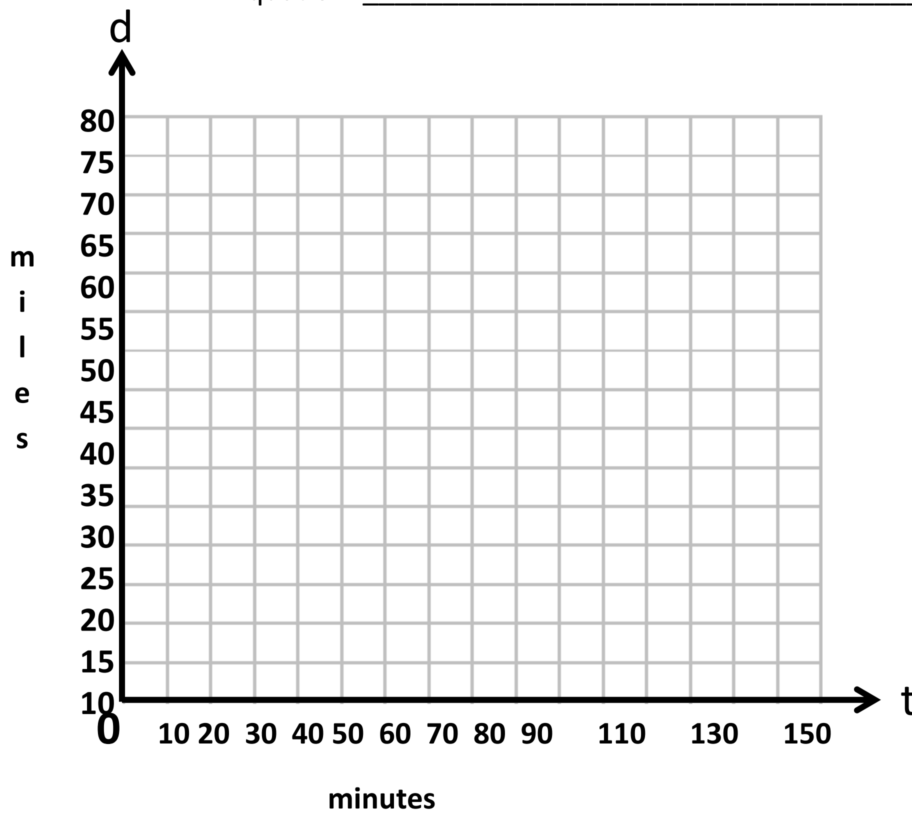
Why am I doing this step?

What does the answer mean to the average person?

C: Rewrite the equation from Part B in the line provided. Use this equation to create a data table showing the relationship between time (in 5 minute increments) and distance to work (in miles). Draw a graph using the data or equation.

Equation: ____

Time (t)	Distance (d)



C R 2

D: If Buttercup stops at a Drive-Thru on her way to work, 10 minutes is added to her total travel time. Write a new equation to explain her trips to work when she stops at a Drive-Thru. Make a new data table below. Make a second line on the above graph to represent this new expression. Explain the combined graph.

New Equation: ____

Time (t)	Distance (d)

What does the answer mean to the average person?

EX: Malik trades stocks in his retirement account. Every trade costs $5 plus $1 for every $1,000 traded.

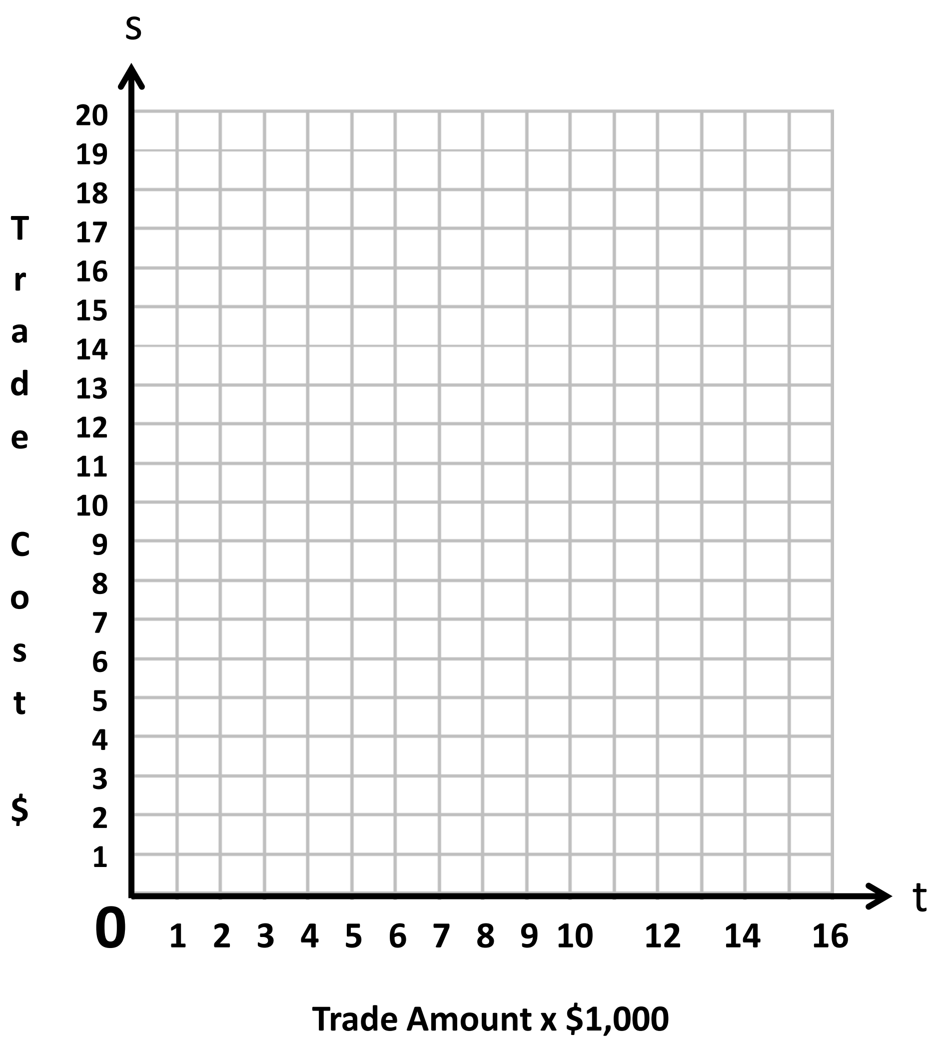
A: Write an equation to find the cost of a stock trade (s) for a given trade amount (t). Explain the slope and intercept values of your equation.

What does the answer mean to the average person?

B: Make a data table for Malik's trades based upon the equation you made in Part A. Graph the data.

C
R
2

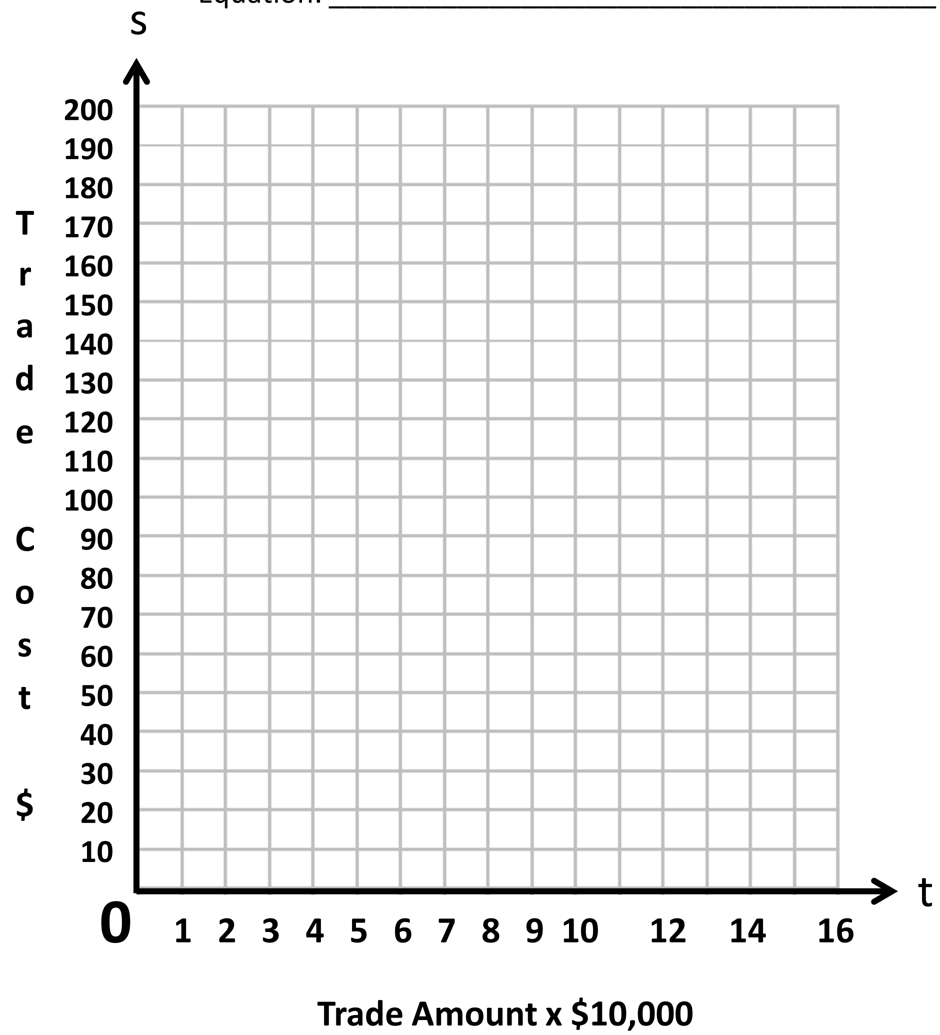
Trade Amount (t)	**Trade Cost (s)**



C: Rewrite the equation from Part A in the line provided. Use this equation to create a new data table showing the relationship between trade amount (this time in $10,000 increments) and trade cost (in dollars). Draw a graph using the data or equation.

Equation: ____

Time (t)	Distance (d)



C
R
2

D: Explain the graphs in Parts B & C.

Explain:

1. Is slope **negative** or **positive**?
2. Which quantity is **increasing**?
3. Which quantity is **decreasing**?
4. What does this **mean** to the average person**?**

Graph Interpretation

Writing Practice

Writing Practice

This section has graphs that the students may practice interpreting.

The rubric is provided with each problem as a guide to answering Keystone questions.

Explain:

1. Is slope **negative** or **positive**?
2. Which quantity is **increasing**?
3. Which quantity is **decreasing**?
4. What does this **mean** to the average person**?**

Step 1: **Explain the slope: + or - ?**

Steps 2 & 3: **State how the variables interact with each other: increasing or decreasing?**

Step 4: **Explain the graph in a non-mathematical way that the average person would understand.**

Example for Completing the Paragraph:

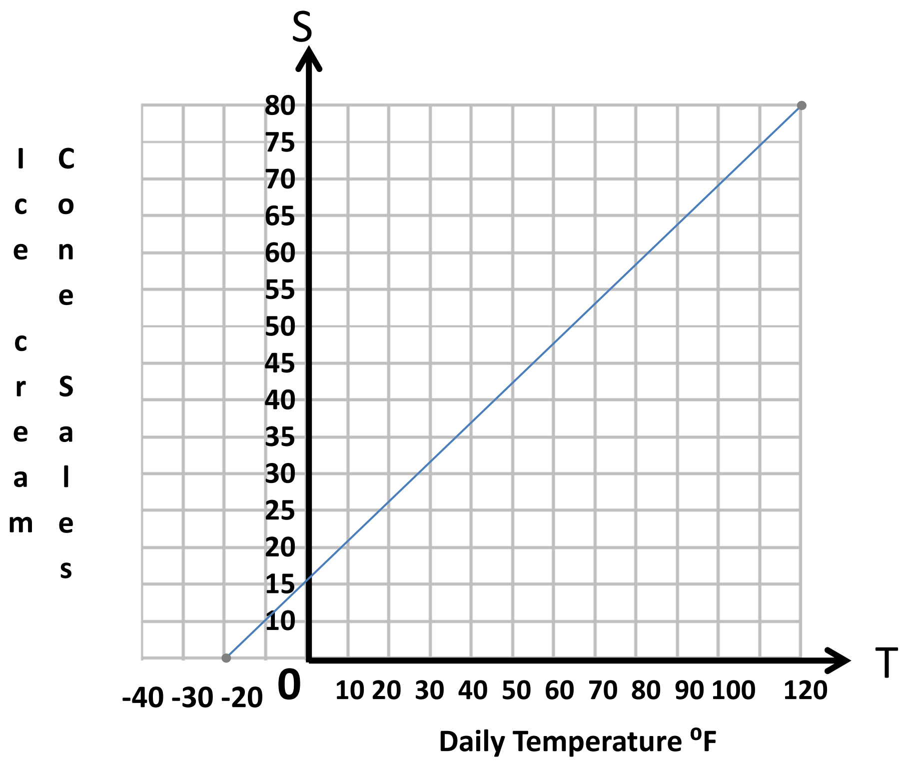
In this problem, I had to interpret the graph by understanding what is occurring with the line.

According to the **graph, the slope will be negative** because **the line is falling to the right**. 1

This means that as the x-value **(miles driven) increases**, the **y-value (gallons of gas in the tank) will decrease**. 3 2

4 To the average person, this **graph** tells us that **the further you drive the amount of gas in your gas tank will decrease**.

Practice Writing

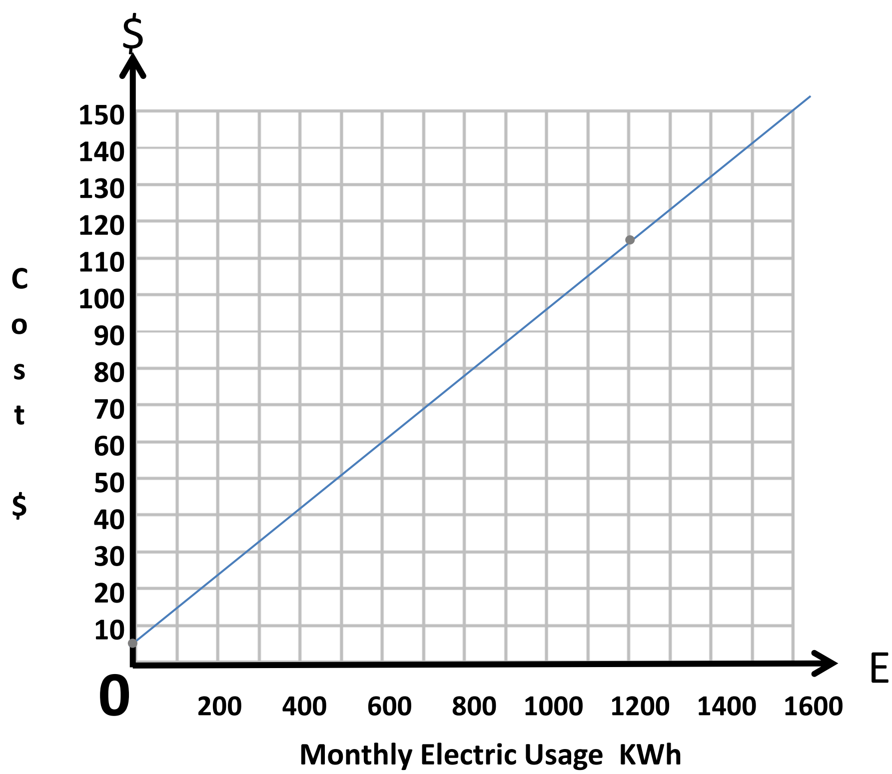


Explain the above graph:

Explain:

1. Is slope **negative** or **positive**?
2. Which quantity is **increasing**?
3. Which quantity is **decreasing**?
4. What does this **mean** to the average person**?**

Writing Practice



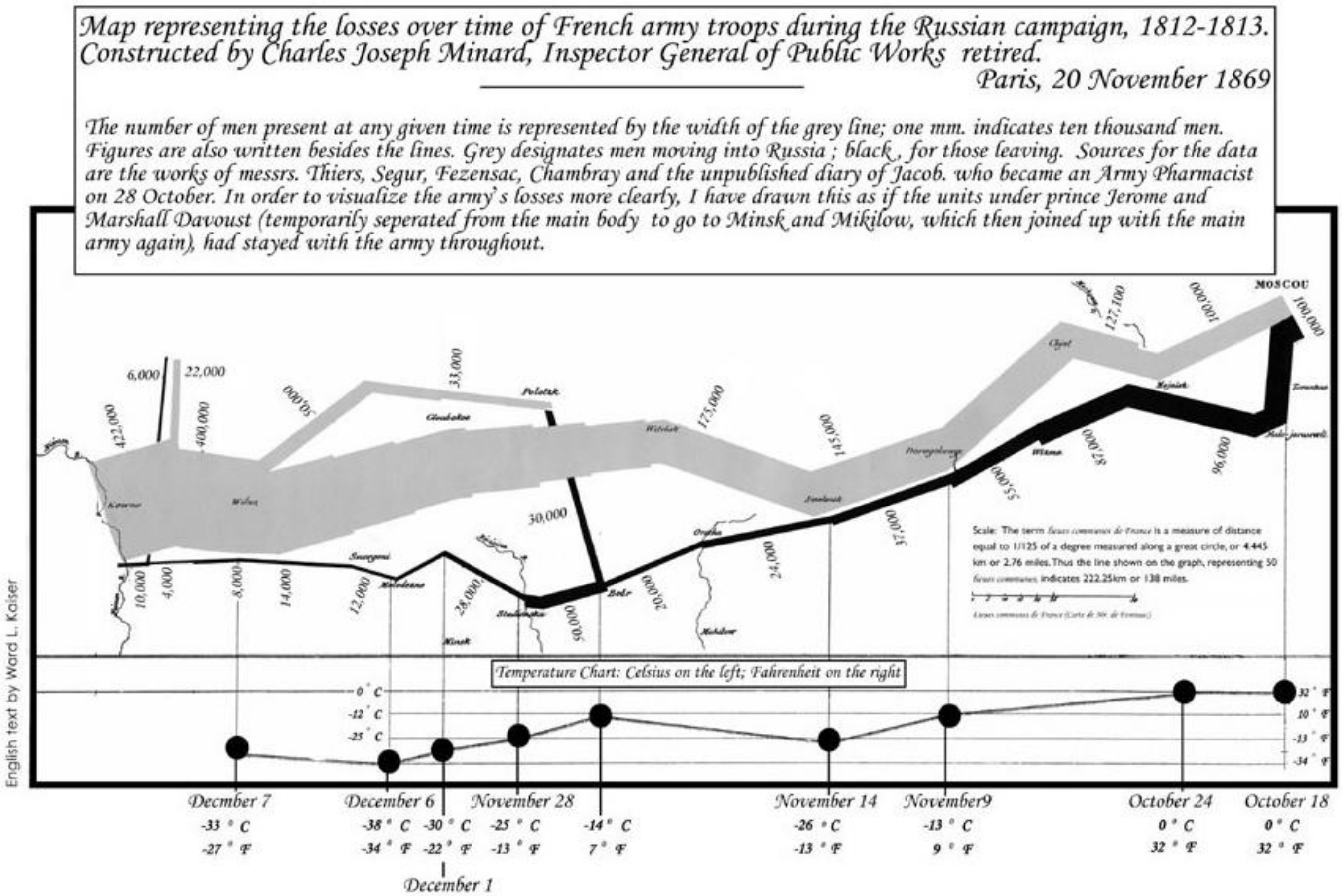
Explain the above graph. If no electric is used for the month, is the customer still billed? Why?

Writing Practice

Suppose the minimum monthly charge is raised $10 per month. Graph the new line above.

Explain:

1. Is slope **negative** or **positive**?
2. Which quantity is **increasing**?
3. Which quantity is **decreasing**?
4. What does this **mean** to the average person**?**



Explain:
1. Is slope **negative** or **positive**?
2. Which quantity is **increasing**?
3. Which quantity is **decreasing**?
4. What does this **mean** to the average person**?**

Approximate Army Size on Return from Moscow

№ Days Marched Below Freezing

Explain the graphs. What happened to Napoleon's Army on the return march from Moscow?

Writing Practice

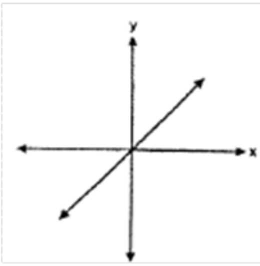
Mixed Practice

multiple choice: 100 problems for practice

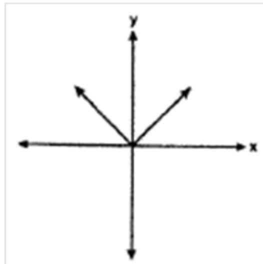
P
r
a
c
t
i
c
e

1. Which graph represents a linear function?

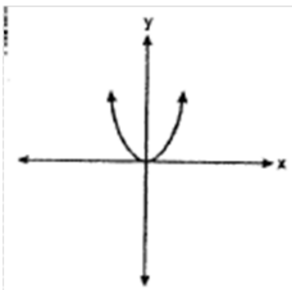
A.



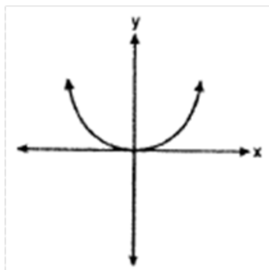
C.



B.



D.



2. What is the slope of the line that passes through the points (-6, 1) and (4, -4)?

1. -2
C. $-\frac{1}{2}$
2. 2
D. $\frac{1}{2}$

3. Students in a ninth grade class measured their heights, h, in centimeters. The height of the shortest student was 155 cm, and the height of the tallest student was 190 cm. What inequality represents the range of heights?

A. $155 < h < 190$

B. $155 \leq h \leq 190$

C. $h \geq 155$ or $h \leq 190$

D. $h > 155$ or $h < 190$

4. The faces of a cube are numbered from 1 to 6. If the cube is tossed once, what is the probability that a prime number or a number divisible by 2 is obtained?

A. $\frac{6}{6}$
C. $\frac{4}{6}$
B. $\frac{5}{6}$
D. $\frac{1}{6}$

5. Which ordered pair is a solution set of the following system of inequalities?

$$y < \frac{1}{2}x + 4$$

$$y \geq -x + 1$$

A. $(-5, 3)$
C. $(3, -5)$
B. $(0, 4)$
D. $(4, 0)$

6. Which expression is equivalent to $(3x^2)^3$?

A. $9x^5$
C. $27x^5$
B. $9x^6$
D. $27x^6$

7. Jack bought 3 slices of cheese pizza and 4 slices of mushroom pizza for a total cost of \$12.50. Grace bought 3 slices of cheese pizza and 2 slices of mushroom pizza for a total cost of \$8.50. What is the cost of one slice of mushroom pizza?

A. \$1.50
C. \$3.00
B. \$2.00
D. \$3.50

Practice

8. What is half of 2^6?

A. 1^3

B. 1^6

C. 2^3

D. 2^5

9. Which equation represents a line that is parallel to the line $y = -4x + 5$?

A. $y = -4x + 3$

B. $y = -\frac{1}{4}x + 5$

C. $y = \frac{1}{4}x + 3$

D. $y = 4x + 5$

10. Pam is playing with red and black marbles. The number of red marbles she has is three more than twice the number of black marbles she has. She has 42 marbles in all. How many red marbles does Pam have?

A. 13

B. 15

C. 29

D. 33

11. What is $\frac{\sqrt{32}}{4}$ expressed in simplest radical form?

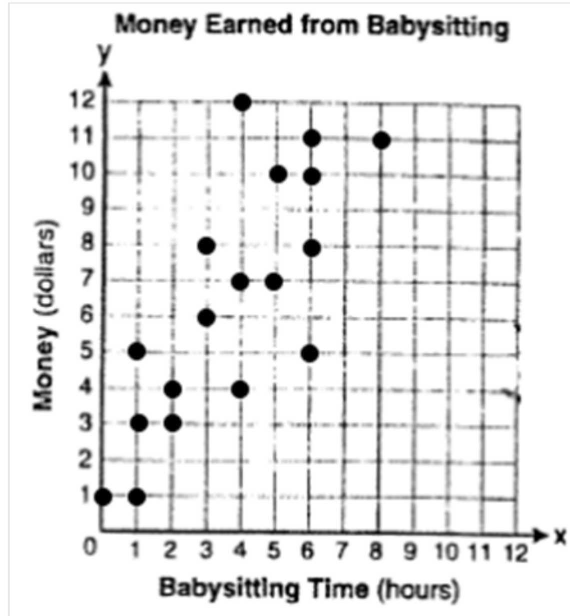
A. $\sqrt{2}$

B. $4\sqrt{2}$

C. $\sqrt{8}$

D. $\frac{\sqrt{8}}{2}$

12. Which equation most closely represents the line of best fit for the scatter plot below?



A. $y = x$

B. $y = \frac{2}{3}x + 1$

C. $y = \frac{3}{2}x + 4$

D. $y = \frac{3}{2}x + 1$

13. In a linear equation the independent variable increases at a constant rate while the dependent variable decreases at a constant rate. The slope of this line is

A. Zero

B. Negative

C. Positive

D. Undefined

14. Which ordered pair is a solution to the system of equations $y = x$ and $y = x^2 - 2$?

A. $(-2, -2)$

B. $(-1, 1)$

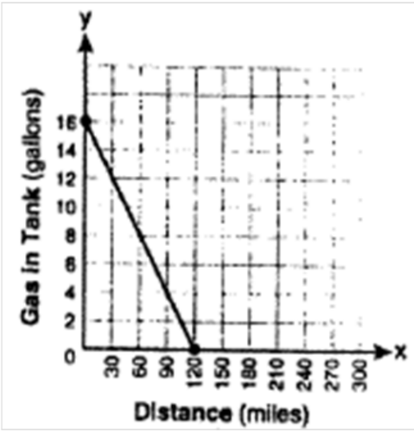
C. $(0, 0)$

D. $(2, 2)$

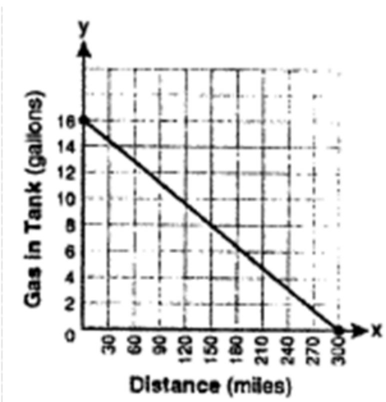
Practice

15. The gas tank in a car holds a total of 16 gallons of gas. The car travels 75 miles on 4 gallons of gas. If the gas tank is full at the beginning of a trip, which graph represents the rate of change in the amount of gas in the tank?

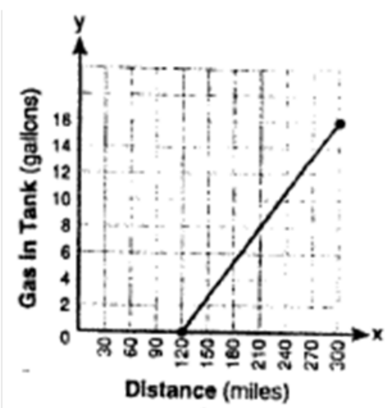
A.



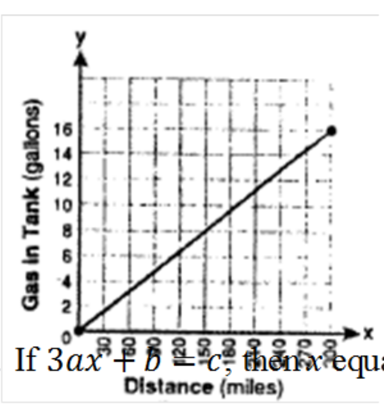
B.



C.



D.



16. If $3ax + b = c$, then x equals

A. $c - b + 3a$

C. $\frac{c-b}{3a}$

B. $c + b - 3a$

D. $\frac{b-c}{3a}$

17. Nicole's aerobics class exercises to fast-paced music. If the rate of the music is 120 beats per minute, how many beats would there be in a class that is 0.75 hour long?

A. 90

C. 5,400

B. 160

D. 7,200

18. The length of the hypotenuse of a right triangle is 34 inches and the length of one of its legs is 16 inches. What is the length, in inches, of the other leg of this right triangle?

A. 16

C. 25

B. 18

D. 30

19. Which equation represents a line parallel to the x-axis?

A. $x = 5$

C. $x = \frac{1}{3}y$

B. $y = 10$

D. $y = 5x + 17$

Practice

20. Sam and Laquan have been selling frozen pizzas for a class fundraiser. Sam has sold half as many pizzas as Laquan. Together they have sold a total of 126 pizzas. How many pizzas did Sam sell?

A. 21 C. 63

B. 42 D. 84

21. Which ordered pair is in the solution set of the system of equations $y = -x + 1$ and $y = x^2 + 5x + 6$?

A. $(-5, -1)$ C. $(5, -4)$

B. $(-5, 6)$ D. $(5, 2)$

22. Which statement is true about the data set 3, 4, 5, 6, 7, 7, 10?

A. Mean = Mode C. Mean = Median

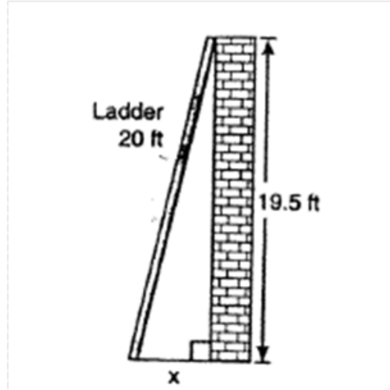
B. Mean > Mode D. Mean < Median

23. Which value of x is in the solution set of the inequality $-4x + 2 > 10$?

A. -2 C. 3

B. 2 D. -4

24. Don placed a ladder against the side of his house as shown in the diagram below.



Which equation could be used to find the distance, x, from the foot of the ladder to the base of the house?

A. $x = 20 - 19.5$

B. $x = 20^2 - 19.5^2$

C. $x = \sqrt{20^2 - 19.5^2}$

D. $x = \sqrt{20^2 + 19.5^2}$

25. Which value of x is a solution of $\frac{5}{x} = \frac{x+13}{6}$?

A. -2 C. -10

B. -3 D. -15

Practice

26. A rectangle has an area of 24 square units. The width is 5 units less than the length. What is the length, in units, of the rectangle?

A. 6

B. 8

C. 3

D. 19

27. The bowling team at Lincoln High School must choose a president, vice president, and secretary. If the team has 10 members, which expression could be used to determine the number of ways the officers could be chosen?

A. ${}_3P_{10}$

B. ${}_7P_3$

C. ${}_{10}P_3$

D. ${}_{10}P_7$

28. The table below shows a cumulative frequency distribution of runners' ages.

Age Group	Total
20-29	8
20-39	18
20-49	25
20-59	31
20-69	35

According to the table, how many runners are in their forties?

A. 25

B. 10

C. 7

D. 6

29. Mr. Turner bought x boxes of pencils. Each box holds 25 pencils. He left 3 boxes of pencils at home and took the rest to school. Which expression represents the total number of pencils he took to school?

A. $22x$

B. $25x - 3$

C. $25 - 3x$

D. $25x - 75$

30. Lenny made a cube in technology class. Each edge measured 1.5 cm. What is the volume of the cube in cubic centimeters?

A. 2.25

B. 3.375

C. 9.0

D. 13.5

31. Which value of p is the solution of $5p - 1 = 2p + 20$?

A. $\frac{19}{7}$

B. $\frac{19}{3}$

C. 3

D. 7

32. The statement $2 + 0 = 2$ is an example of the use of which property of real numbers?

A. associative

B. additive identity

C. additive inverse

D. distributive.

33. Mrs. Smith wrote "Eight less than three times a number is greater than fifteen" on the board. If x represents the number, which inequality is a correct translation of this statement?

A. $3x - 8 > 15$

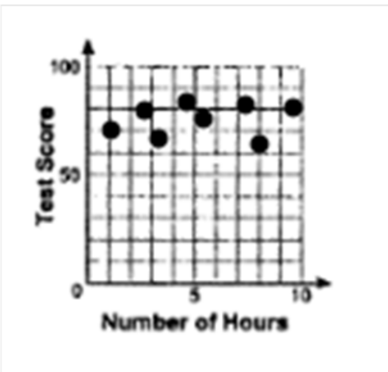
B. $3x - 8 < 15$

C. $8 - 3x > 15$

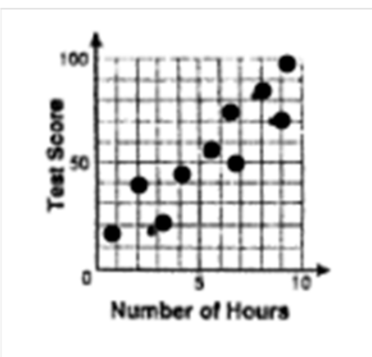
D. $8 - 3x < 15$

34. There is a negative correlation between the number of hours a student watches television and his or her social studies test score. Which scatter plot below displays this correlation?

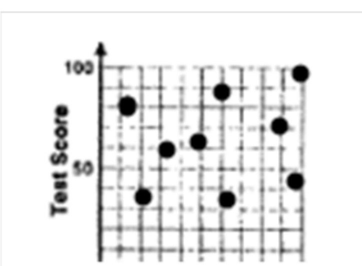
A.



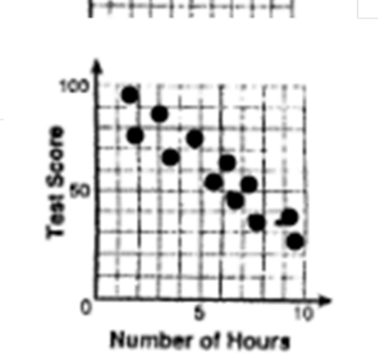
B.



C.



D.



35. When $3g^2 - 4g + 2$ is subtracted from $7g^2 + 5g - 1$, the difference is

A. $-4g^2 - 9g + 3$

B. $4g^2 + g + 1$

C. $4g^2 + 9g - 3$

D. $10g^2 + g + 1$

36. Factored completely, the expression $2x^2 + 10x - 12$ is equivalent to

A. $2(x - 6)(x + 1)$

B. $2(x + 6)(x - 1)$

C. $2(x + 2)(x + 3)$

D. $2(x - 2)(x - 3)$

37. Factored, the expression $16x^2 - 25y^2$ is equivalent to

A. $(4x - 5y)(4x + 5y)$

B. $(4x - 5y)(4x - 5y)$

C. $(8x - 5y)(8x + 5y)$

D. $(8x - 5y)(8x - 5y)$

38. What is the product of $-3x^2y$ and $(5xy^2 + xy)$?

A. $-15x^3y^3 - 3x^3y^2$

B. $-15x^3y^3 - 3x^3y$

C. $-15x^2y^2 - 3x^2y$

D. $-15x^3y^3 + xy$

39. Which value of x makes the expression $\frac{x+4}{x-3}$ undefined?

A. -4

B. -3

C. 3

D. 0

40. Which expression represents $\frac{25x-125}{x^2-25}$ in simplest form?

A. $\frac{5}{x}$

B. $-\frac{5}{x}$

C. $\frac{25}{x-5}$

D. $\frac{25}{x+5}$

41. What is the product of $\frac{x^2-1}{x+1}$ and $\frac{x+3}{3x-3}$ expressed in simplest form?

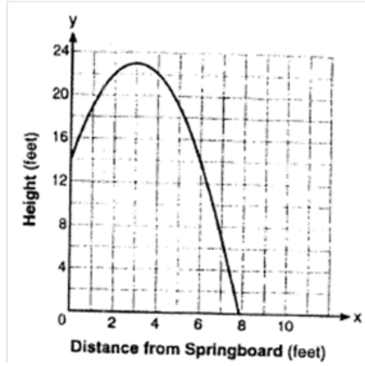
A. x

B. $\frac{x}{3}$

C. $x+3$

D. $\frac{x+3}{3}$

42. A swim team member performs a dive from a 14-foot high springboard. The parabola shows the path of her dive.



Which equation represents the axis of symmetry?

A. $x = 3$

B. $y = 3$

C. $x = 23$

D. $y = 23$

43. Which expression represents $\frac{2x^3-12x}{x-6}$ in simplest form?

A. 0

B. $2x$

C. $4x$

D. $2x + 2$

44. Consider the graph of the equation $y = ax^2 + bx + c$, when $a \neq 0$. If a is multiplied by 3, what is true of the graph of the resulting parabola?

A. The vertex is 3 units above the vertex of the original parabola.

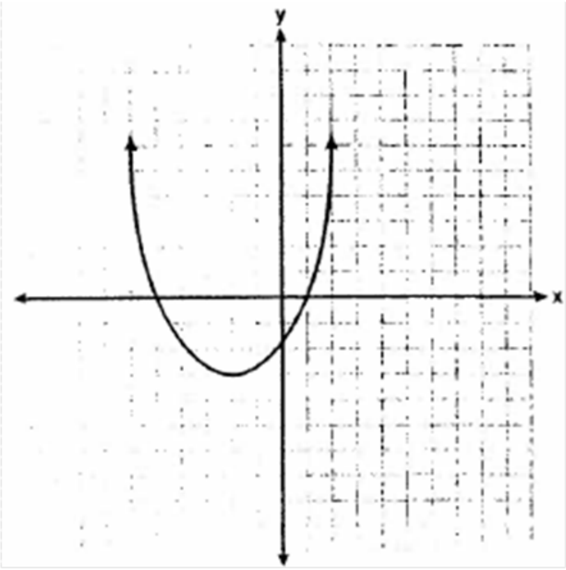
B. The new parabola is 3 units to the right of the original parabola.

C. The new parabola is wider than the original parabola.

D. The new parabola is narrower than the original parabola.

Practice

45. What are the vertex and the axis of symmetry of the parabola shown in the diagram below?



A. The vertex is (-2, -3) and the axis of symmetry is $x = -2$.

B. The vertex is (-2, -3) and the axis of symmetry is $y = -2$.

C. The vertex is (-3, -2) and the axis of symmetry is $y = -2$.

D. The vertex is (-3, -2) and the axis of symmetry is $x = -2$.

46. What is the product of $\frac{4x}{x-1}$ and $\frac{x^2-1}{3x+3}$ expressed in simplest form?

A. $\frac{4x}{3}$

B. $\frac{4x^2}{3}$

C. $\frac{4x^2}{3(x+1)}$

D. $\frac{4(x+1)}{3}$

47. Is the equation $3(2x - 4) = -18$ equivalent to $6x - 12 = -18$?

A. Yes, the equations are equivalent by the Associative Property of Multiplication.

B. Yes, the equations are equivalent by the Commutative Property of Multiplication.

C. Yes, the equations are equivalent by the Distributive Property of Multiplication.

D. No, the equations are not equivalent.

48. $\sqrt{16} + \sqrt[3]{8} =$

A. 4

B. 6

C. 9

D. 10

49. Which expression is equivalent to x^6x^2?

A. x^4x^3

B. x^5x^3

C. x^7x^3

D. x^9x^3

50. Which number does <u>not</u> have a reciprocal?

A. -1

B. 0

C. $\frac{1}{1000}$

D. 3

51. What is the multiplicative inverse of ½?

A. -2

B. $-\frac{1}{2}$

C. $\frac{1}{2}$

D. 2

52. What is the solution for this equation?

$$|2x - 3| = 5$$

A. $x = -4$ or $x = 4$

B. $x = -4$ or $x = 3$

C. $x = -1$ or $x = 4$

D. $x = -1$ or $x = 3$

53. What is the solution set of the inequality

$$5 - |x + 4| \leq -3?$$

A. $-2 \leq x \leq 6$

B. $x \leq -2$ or $x \geq 6$

C. $-12 \leq x \leq 4$

D. $x \leq -12$ or $x \geq 4$

54. Which equation is equivalent to

$$5x - 2(7x + 1) = 14x?$$

A. $-9x - 2 = 14x$

B. $-9x + 1 = 14x$

C. $-9x + 2 = 14x$

D. $12x - 1 = 14x$

55. Which equation is equivalent to

$$4(2 - 5x) = 6 - 3(1 - 3x)?$$

A. $8x = 5$

B. $8x = 17$

C. $29x = 5$

D. $29x = 17$

56. The total cost (c) in dollars of renting a sailboat for n days is given by the equation

$$c = 120 + 60n$$

If the total cost was \$360, for how many days was the sailboat rented?

A. 2

B. 4

C. 6

D. 8

57. Solve: $3(x + 5) = 2x + 35$

Step 1: $3x + 15 = 2x + 35$
Step 2: $5x + 15 = 35$
Step 3: $5x = 20$
Step 4: $x = 4$

Which is the first <u>incorrect</u> step in the solution shown above?

A. Step 1

B. Step 2

C. Step 3

D. Step 4

Practice

58. A 120-foot-long rope is cut into 3 pieces. The first piece of rope is twice as long as the second piece of rope. The third piece of rope is three times as long as the second piece of rope. What is the length of the longest piece of rope?

A. 20 feet
B. 40 feet
C. 60 feet
D. 80 feet

59. The cost to rent a construction crane is $750 per day plus $250 per hour for use. What is the maximum number of hours the crane can be used each day if the rental cost is not to exceed $2500 per day?

A. 2.5
B. 3.7
C. 7.0
D. 13.0

60. What is the solution to the inequality $x - 5 > 14$?

A. $x > 9$
B. $x < 9$
C. $x > 19$
D. $x < 19$

61. The lengths of the sides of a triangle are y, $y + 1$, and 7 centimeters. If the perimeter is 56 centimeters, what is the value of y?

A. 24
B. 25
C. 31
D. 25

62. Which number serves as a counterexample to this statement below?

All positive integers are divisible by 2 or 3.

A. 100
B. 57
C. 30
D. 25

63. What is the conclusion of the statement in the box below?

If $x^2 = 4$, then $x = -2$ or $x = 2$.

A. $x^2 = 4$
B. $x = 2$
C. $x = -2$
D. $x = -2$ or $x = 2$

64. Which of the following is a valid conclusion to the statement "If a student is a high school band member, then the student is a good musician"?

A. All good musicians are high school band members.
B. A student is a high school band member.
C. All students are good musicians.
D. All high school band members are good musicians.

Practice

65. The chart below shows an expression evaluated for hour different values of x.

x	$x^2 + x + 5$
1	7
2	11
6	47
7	61

Josiah concluded that for all positive values of x, $x^2 + x + 5$ produces a prime number. Which value of x serves as a counterexample to prove Josiah's conclusion false?

A. 5

B. 11

C. 16

D. 21

66. John's solution to an equation is shown below.

Given: $x^2 + 5x + 6 = 0$

Step 1: $(x + 2)(x + 3) = 0$

Step 2: $x + 2 = 0$ or $x + 3 = 0$

Step 3: $x = -2$ or $x = -3$

Which property of real numbers did John use for Step 2?

A. Multiplication Property of Equality

B. Zero Product Property of Multiplication

C. Commutative Property of Multiplication

D. Distributive Property of Multiplication over Addition

67. Stan's solution to an equation is shown below.

Given: $n + 8(n + 20) = 110$

Step 1: $n + 8n + 20 = 110$

Step 2: $9n + 20 = 110$

Step 3: $9n = 110 - 20$

Step 4: $9n = 90$

Step 5: $\frac{9n}{9} = \frac{90}{9}$

Step 6: $n = 10$

Which statement about Stan's solution is true?

A. Stan's solution is correct.

B. Stan made a mistake in Step 1.

C. Stan made a mistake in Step 3.

D. Stan made a mistake in Step 5.

68. When is this statement true?

The opposite of a number is less than the original number.

A. This statement in never true.

B. This statement is always true.

C. This statement is true for positive numbers.

D. This statement is true for negative numbers.

69. What is the y-intercept of the graph of $4x + 2y = 12$?

A. – 4

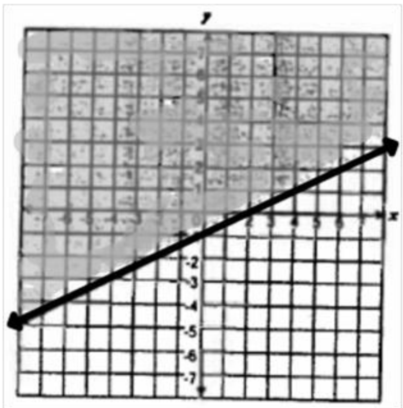
B. – 2

C. 6

D. 12

Practice

70. Which inequality is shown on the graph below?



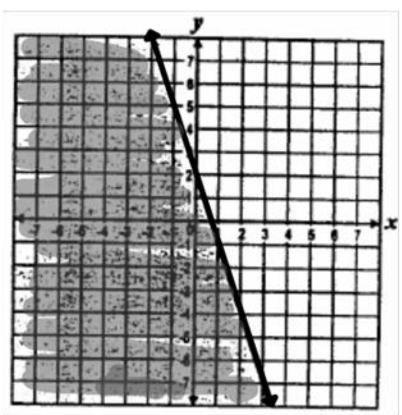
A. $y < \frac{1}{2}x - 1$

B. $y \leq \frac{1}{2}x - 1$

C. $y > \frac{1}{2}x - 1$

D. $y \geq \frac{1}{2}x - 1$

71. Which inequality does the shaded region of the graph represent?



A. $3x + y \leq 2$

B. $3x + y \geq 2$

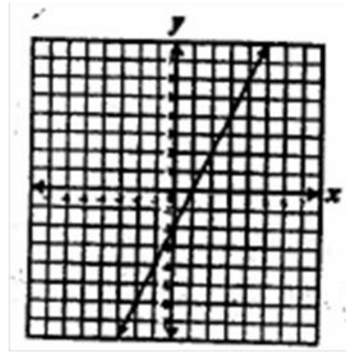
C. $3x + y \leq -2$

D. $3x + y \geq -2$

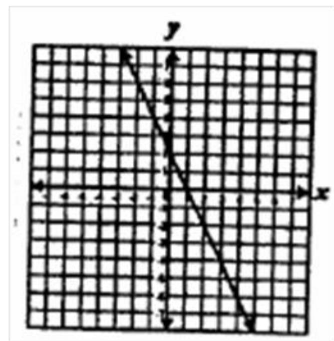
72. Which <u>best</u> represents the graph of

$y = 2x - 2$?

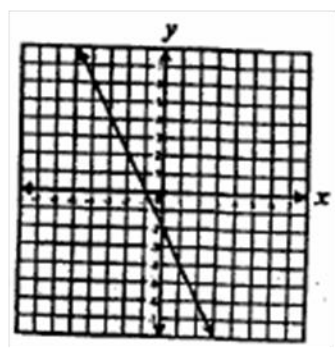
A.



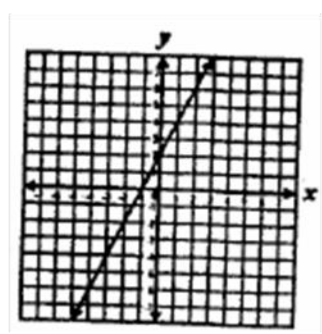
B.



C.

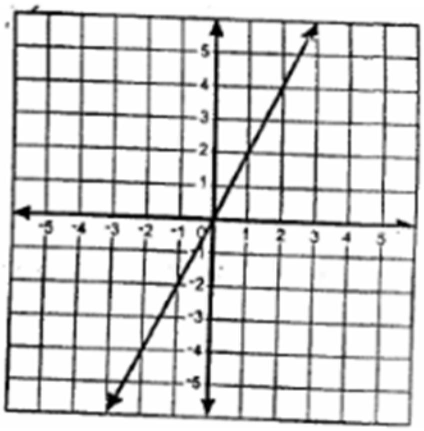


D.



Practice

73. Which equation best represents the graph below?



A. $y = x$

B. $y = 2x$

C. $y = x + 2$

D. $y = 2x + 2$

74. Which point lies on the line defined by $3x + 6y = 2$?

A. (0, 2)

B. (0, 6)

C. $\left(1, -\frac{1}{6}\right)$

D. $\left(1, -\frac{1}{3}\right)$

What is the equation of the line that has a slope of 4 and passes through the point (3, -10)?

A. $y = 4x - 22$

B. $y = 4x + 22$

C. $y = 4x - 43$

D. $y = 4x + 43$

76. The data in the table shows the cost of renting a bicycle by the hour, including a deposit.

Hours (h)	Cost in dollars (c)
2	15
5	30
8	45

If hours, h, were graphed on the horizontal axis and cost, c, were graphed on the vertical axis, what would the equation of a line be that fits the data?

A. $c = 5h$

B. $c = \frac{1}{5}h + 5$

C. $c = 5h + 5$

D. $c = 5h - 5$

77. Some ordered pairs for a linear function of x are given in the table below.

x	y
1	1
3	7
5	13
7	19

Which of the following equations was used to generate the table above?

A. $y = 2x + 1$

B. $y = 2x - 1$

C. $y = 3x - 2$

D. $y = 4x - 3$

Practice

78. The equation of the line l is $6x + 5y = 3$, and the equation of line q is $5x - 6y = 0$. Which statement about the two lines is true?

A. Lines l and q have the same y-intercept.

B. Lines l and q are parallel.

C. Lines l and q have the same x-intercept.

D. Lines l and q are perpendicular.

79. Which equation represents a line that is parallel to $y = -\frac{5}{4}x + 2$?

A. $y = -\frac{5}{4}x + 1$

B. $y = -\frac{4}{5}x + 2$

C. $y = \frac{4}{5}x + 3$

D. $y = \frac{5}{4}x + 4$

80. What is the solution to this system of equations?

$$y = -3x - 2$$
$$6x + 2y = -4$$

A. (6, 2)

B. (1, -5)

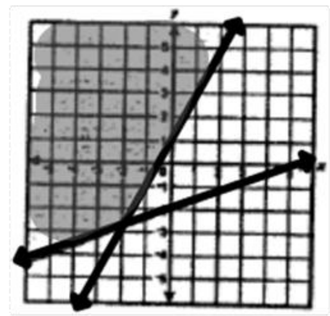
C. No solution

D. Infinitely many solutions

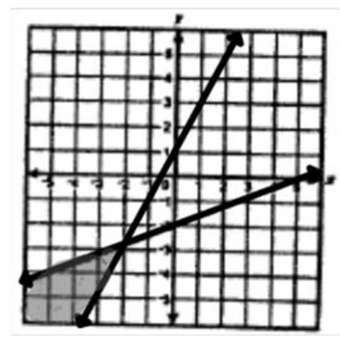
81. Which graph best represents the solution to this system of inequalities?

$$2x \geq y - 1$$
$$2x - 5y \leq 10$$

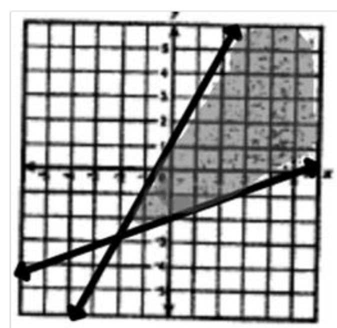
A.



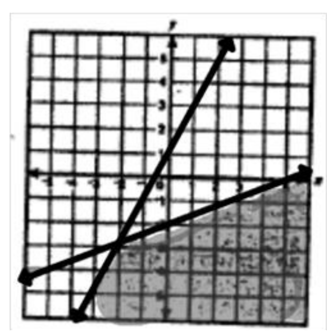
B.



C.



D.



Practice

82. Which ordered pair is the solution to the system of equations below?

$$x + 3y = 7$$
$$x + 2y = 10$$

A. $\left(\frac{7}{2}, \frac{13}{4}\right)$

B. $\left(\frac{7}{2}, \frac{17}{5}\right)$

C. (-2, -3)

D. (16, -3)

83. Marcy has a total of 100 dimes and quarters. If the total value of the coins is \$14.05, how many quarters does she have?

A. 27

B. 40

C. 56

D. 73

84. Which of the following best describes the graph of this system of equations?

$$y = -2x + 3$$
$$5y = -10x + 15$$

A. Two identical lines

B. Two parallel lines

C. Two lines intersection in only one point

D. Two lines intersecting in only two points

85. $\frac{5x^3}{10x^7} =$

A. $2x^4$

B. $\frac{1}{2x^4}$

C. $\frac{1}{5x^4}$

D. $\frac{x^4}{5}$

86. $(4x^2 - 2x + 8) - (x^2 + 3x - 2) =$

A. $3x^2 + x + 6$

B. $3x^2 + x + 10$

C. $3x^2 - 5x + 6$

D. $3x^2 - 5x + 10$

87. The sum of two binomials is $5x^2 - 6x$. If one of the binomials is $3x^2 - 2x$, what is the other binomial?

A. $2x^2 - 4x$

B. $2x^2 - 8x$

C. $8x^2 + 4x$

D. $8x^2 - 8x$

88. Which of the following expressions is equal to $(x + 2) + (x - 2)(2x + 1)$?

A. $2x^2 - 2x$

B. $2x^2 - 4x$

C. $2x^2 + x$

D. $4x^2 + 2x$

89. A volleyball court is shaped like a rectangle. It has a width of x meters and a length of $2x$ meters. Which of the expressions gives the area of the court in square meters?

A. $3x$

B. $2x^2$

C. $3x^2$

D. $2x^3$

Practice

90. Which is the factored form of $3a^2 - 24ab + 48b^2$?

A. $(3a - b)(a - 6b)$
B. $(3a - 16)(a - 3b)$
C. $3(a - 4b)(a - 4b)$
D. $3(a - 8b)(a - 8b)$

91. Which is a factor of $x^2 - 11x + 24$?

A. $x + 3$
B. $x - 3$
C. $x + 4$
D. $x - 4$

92. Which of the following shows $9t^2 + 12t + 4$ factored completely?

A. $(3t + 2)^2$
B. $(3t + 4)(3t + 1)$
C. $(9t + 4)(t + 1)$
D. $9t^2 + 12t + 4$

93. What is the complete factorization of $32 - 8z^2$?

A. $-8(2 + z)(2 - z)$
B. $8(2 + z)(2 - z)$
C. $-8(2 + z)^2$
D. $8(2 - z)^2$

94. If x^2 is added to x, the sum is 42. Which of the following could be the value of x?

A. – 7
B. – 6
C. 14
D. 42

95. Two airplanes left the same airport traveling in opposite directions. If one airplane averages 400 miles per hour and the other airplane averages 250 miles per hour, in how many hours will the distance between the two planes be 1625 miles?

A. 2.5
B. 4
C. 5
D. 10.8

96. Lisa will make punch that is 25% fruit juice by adding pure fruit juice to a 2-liter mixture that is 10% pure fruit juice. How many liters of pure fruit juice does she need to add?

A. 0.4 liters
B. 0.5 liters
C. 2 liters
D. 8 liters

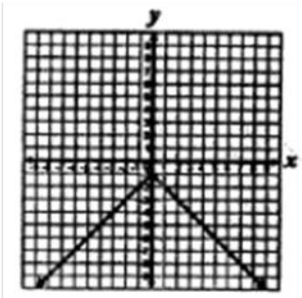
97. Which relation is a function?

A. $\{(-1,3),(-2,6),(0,0),(-2,-2)\}$
B. $\{(-2,-2),(0,0),(1,1),(2,2)\}$
C. $\{(4,0),(4,1),(4,2),(4,3)\}$
D. $\{(7,4),(8,8),(10,8),(10,10)\}$

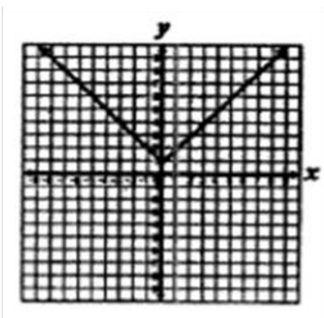
Practice

98. For which equation graphed below are <u>all</u> the y-values negative?

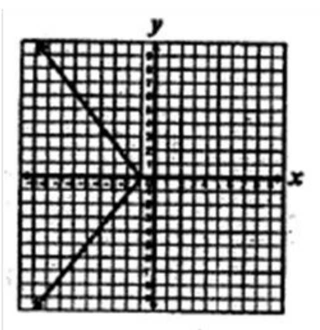
A.



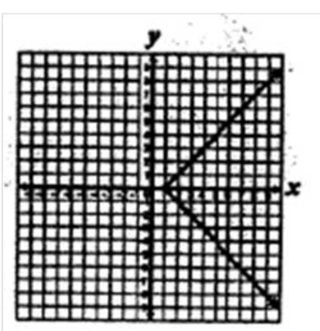
B.



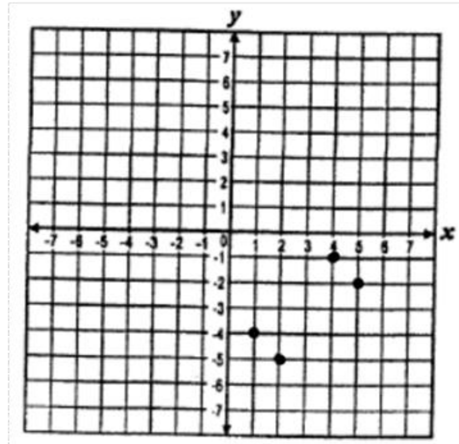
C.



D.



99. What is the domain of the function shown on the graph below?



A. $\{-1, -2, -3, -4\}$

B. $\{-1, -2, -4, -5\}$

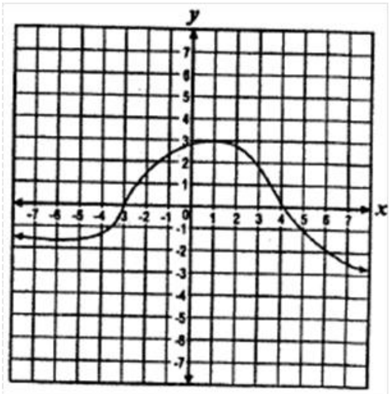
C. $\{1, 2, 3, 4\}$

D. $\{1, 2, 4, 5\}$

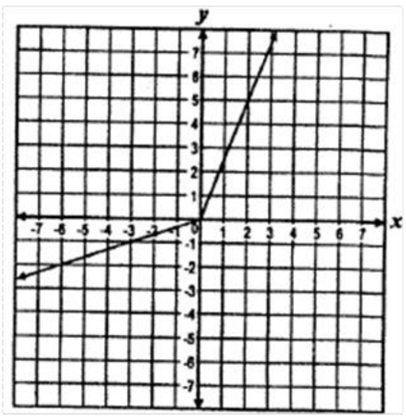
Practice

100. Which of the following graphs represents a relation that is <u>not</u> a function of x?

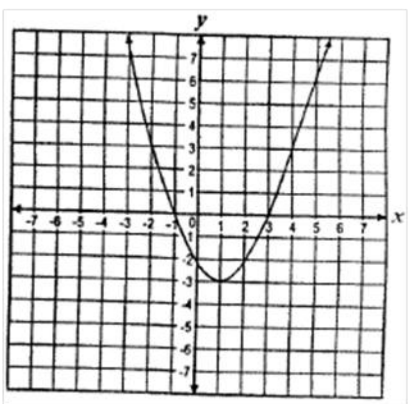
A.



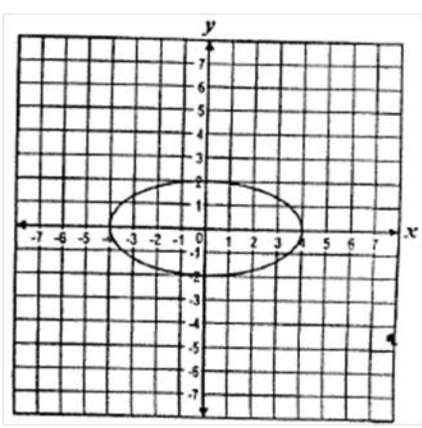
B.



C.



D.

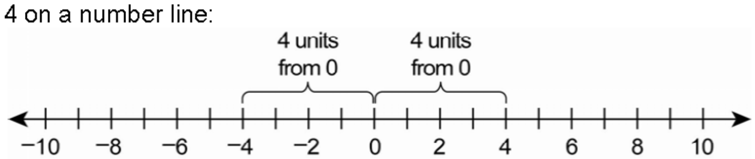


Glossary

Addendum

Absolute Value

A number's distance from zero on the number line. It is written |*a*| and is read "the absolute value of *a*." It results in a number greater than or equal to zero (e.g., |4| = 4 and |$^{-}$4| = 4). Example of absolute values of $^{-}$4 and 4 on a number line:



Additive Inverse

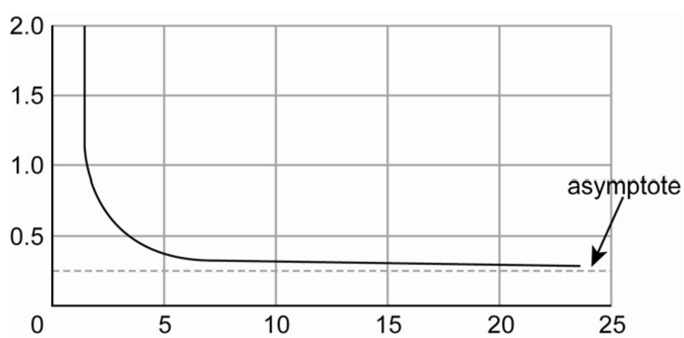
The opposite of a number (i.e., for any number *a*, the additive inverse is $^{-}$*a*). Any number and its additive inverse will have a sum of zero (e.g., $^{-}$4 is the additive inverse of 4 since 4 + $^{-}$4 = 0; likewise, the additive inverse of $^{-}$4 is 4 since $^{-}$4 + 4 = 0).

Arithmetic Sequence

An ordered list of numbers that increases or decreases at a constant rate (i.e., the difference between numbers remains the same). Example: 1, 7, 13, 19, … is an arithmetic sequence as it has a constant difference of +6 (i.e., 6 is added over and over).

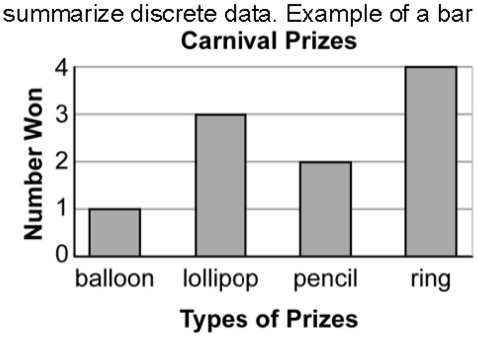
Asymptote

A straight line to which the curve of a graph comes closer and closer. The distance between the curve and the asymptote approaches zero as they tend to infinity. The asymptote is denoted by a dashed line on a graph. The most common asymptotes are horizontal and vertical. Example of a horizontal asymptote:



Bar Graph

A graph that shows a set of frequencies using bars of equal width, but heights that are proportional to the frequencies. It is used to summarize discrete data. Example of a bar graph:

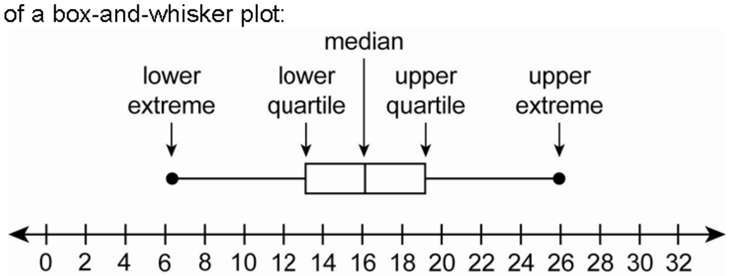


Binomial

A polynomial with two unlike terms (e.g., $3x + 4y$ or $a^3 - 4b^2$). Each term is a monomial, and the monomials are joined by an addition symbol (+) or a subtraction symbol (–). It is considered an algebraic expression.

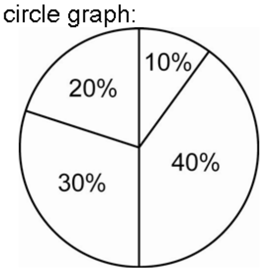
Box-and-Whisker Plot

A graphic method for showing a summary and distribution of data using median, quartiles, and extremes (i.e., minimum and maximum) of data. This shows how far apart and how evenly data is distributed. It is helpful when a visual is needed to see if a distribution is skewed or if there are any outliers. Example of a box-and-whisker plot:



Circle Graph (or Pie Chart)

A circular diagram using different-sized sectors of a circle whose angles at the center are proportional to the frequency. Sectors can be visually compared to show information (e.g., statistical data). Sectors resemble slices of a pie. Example of a circle graph:



Coefficient

The number, usually a constant, that is multiplied by a variable in a term (e.g., 35 is the coefficient of $35x^2y$); the absence of a coefficient is the same as a 1 being present (e.g., x is the same as $1x$).

Combination

An unordered arrangement, listing or selection of objects (e.g., two-letter combinations of the three letters X, Y, and Z would be XY, XZ, and YZ; XY is the same as YX and is not counted as a different combination). A combination is similar to, but not the same as, a permutation.

Common Logarithm

A logarithm with base 10. It is written log x. The common logarithm is the power of 10 necessary to equal a given number (i.e., $\log x = y$ is equivalent to $10^y = x$).

Complex Number

The sum or difference of a real number and an imaginary number. It is written in the form $a + bi$, where a and b are real numbers and i is the imaginary unit (i.e., $i = \sqrt{^-1}$). The a is called the real part, and the bi is called the imaginary part.

Composite Number

Any natural number with more than two factors (e.g., 6 is a composite number since it has four factors: 1, 2, 3, and 6). A composite number is not a prime number.

Compound (or Combined) Event

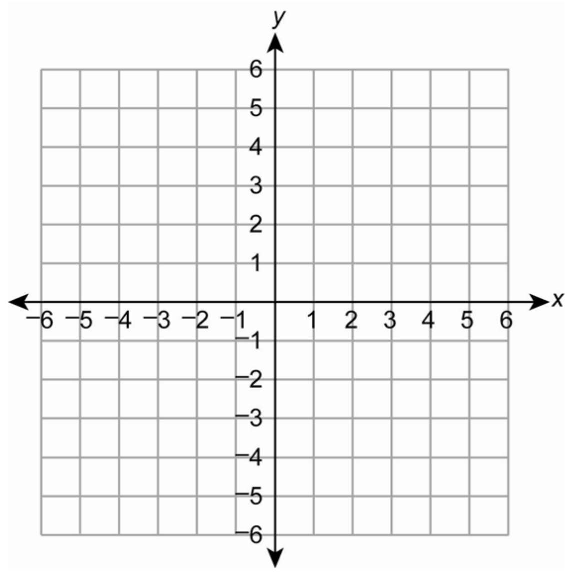
An event that is made up of two or more simple events, such as the flipping of two or more coins.

Compound Inequality

When two or more inequalities are taken together and written with the inequalities connected by the words *and* or *or* (e.g., $x > 6$ and $x < 12$, which can also be written as $6 < x < 12$).

Constant
A term or expression with no variable in it. It has the same value all the time.

Coordinate Plane
A plane formed by perpendicular number lines. The horizontal number line is the x-axis, and the vertical number line is the y-axis. The point where the axes meet is called the origin. Example of a coordinate plane:



Cube Root
One of three equal factors (roots) of a number or expression; a radical expression with a degree of 3 (e.g., $\sqrt[3]{a}$). The cube root of a number or expression has the same sign as the number or expression under the radical (e.g., $\sqrt[3]{-343x^6} = {}^-(7x^2)$ and $\sqrt[3]{343x^6} = 7x^2$).

Curve of Best Fit (for a Scatter Plot)
See line or curve of best fit (for a scatter plot).

Degree (of a Polynomial)
The value of the greatest exponent in a polynomial.

Dependent Events
Two or more events in which the outcome of one event affects or influences the outcome of the other event(s).

Dependent Variable
The output number or variable in a relation or function that depends upon another variable, called the independent variable, or input number (e.g., in the equation $y = 2x + 4$, y is the dependent variable since its value depends on the value of x). It is the variable for which an equation is solved. Its values make up the range of the relation or function.

Domain (of a Relation or Function)
The set of all possible values of the independent variable on which a function or relation is allowed to operate. Also, the first numbers in the ordered pairs of a relation; the values of the x-coordinates in (x, y).

Elimination Method
See linear combination.

Equation	A mathematical statement or sentence that says one mathematical expression or quantity is equal to another (e.g., $x + 5 = y - 7$). An equation will always contain an equal sign (=).
Estimation Strategy	An approximation based on a judgment; may include determining approximate values, establishing the reasonableness of answers, assessing the amount of error resulting from estimation, and/or determining if an error is within acceptable limits.
Exponent	The power to which a number or expression is raised. When the exponent is a fraction, the number or expression can be rewritten with a radical sign (e.g., $x^{3/4} = \sqrt[4]{x^3}$). See also positive exponent and negative exponent.
Exponential Equation	An equation with variables in its exponents (e.g., $4^x = 50$). It can be solved by taking logarithms of both sides.
Exponential Expression	An expression in which the variable occurs in the exponent (such as 4^x rather than x^4). Often it occurs when a quantity changes by the same factor for each unit of time (e.g., "doubles every year" or "decreases 2% each month").
Exponential Function (or Model)	A function whose general equation is $y = a \bullet b^x$ where a and b are constants.
Exponential Growth/Decay	A situation where a quantity increases or decreases exponentially by the same factor over time; it is used for such phenomena as inflation, population growth, radioactivity or depreciation.
Expression	A mathematical phrase that includes operations, numbers, and/or variables (e.g., $2x + 3y$ is an algebraic expression, $13.4 - 4.7$ is a numeric expression). An expression does not contain an equal sign (=) or any type of inequality sign.
Factor (noun)	The number or expression that is multiplied by another to get a product (e.g., 6 is a factor of 30, and $6x$ is a factor of $42x^2$).
Factor (verb)	To express or write a number, monomial, or polynomial as a product of two or more factors.
Factor a Monomial	To express a monomial as the product of two or more monomials.
Factor a Polynomial	To express a polynomial as the product of monomials and/or polynomials (e.g., factoring the polynomial $x^2 + x - 12$ results in the product $(x - 3)(x + 4)$).
Frequency	How often something occurs (i.e., the number of times an item, number, or event happens in a set of data).
Function	A relation in which each value of an independent variable is associated with a unique value of a dependent variable (e.g., one element of the domain is paired with one and only one element of the range). It is a mapping which involves either a one-to-one correspondence or a many-to-one correspondence, but not a one-to-many correspondence.

Fundamental Counting Principle — A way to calculate all of the possible combinations of a given number of events. It states that if there are x different ways of doing one thing and y different ways of doing another thing, then there are xy different ways of doing both things. It uses the multiplication rule.

Geometric Sequence — An ordered list of numbers that has the same ratio between consecutive terms (e.g., 1, 7, 49, 343, … is a geometric sequence that has a ratio of 7/1 between consecutive terms; each term after the first term can be found by multiplying the previous term by a constant, in this case the number 7 or 7/1).

Greatest Common Factor (GCF) — The largest factor that two or more numbers or algebraic terms have in common. In some cases the GCF may be 1 or one of the actual numbers (e.g., the GCF of $18x^3$ and $24x^5$ is $6x^3$).

Imaginary Number — The square root of a negative number, or the opposite of the square root of a negative number. It is written in the form bi, where b is a real number and i is the imaginary root (i.e., $i = \sqrt{^-1}$ or $i^2 = {^-1}$).

Independent Event(s) — Two or more events in which the outcome of one event does *not* affect the outcome of the other event(s) (e.g., tossing a coin and rolling a number cube are independent events). The probability of two independent events (A and B) occurring is written $P(A$ and $B)$ or $P(A \text{ I } B)$ and equals $P(A) \cdot P(B)$ (i.e., the product of the probabilities of the two individual events).

Independent Variable — The input number or variable in a relation or function whose value is subject to choice. It is not dependent upon any other values. It is usually the x-value or the x in $f(x)$. It is graphed on the x-axis. Its values make up the domain of the relation or function.

Inequality — A mathematical sentence that contains an inequality symbol (i.e., >, <, ≥, ≤, or ≠). It compares two quantities. The symbol > means greater than, the symbol < means less than, the symbol ≥ means greater than or equal to, the symbol ≤ means less than or equal to, and the symbol ≠ means not equal to.

Integer — A natural number, the additive inverse of a natural number, or zero. Any number from the set of numbers represented by $\{\ldots, {^-3}, {^-2}, {^-1}, 0, 1, 2, 3, \ldots\}$.

Interquartile Range (of Data) — The difference between the first (lower) and third (upper) quartile. It represents the spread of the middle 50% of a set of data.

Inverse (of a Relation) — A relation in which the coordinates in each ordered pair are switched from a given relation. The point (x, y) becomes (y, x), so (3, 8) would become (8, 3).

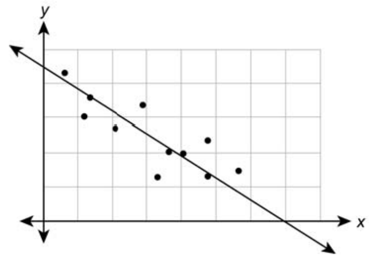
Irrational Number — A real number that cannot be written as a simple fraction (i.e., the ratio of two integers). It is a non-terminating (infinite) and non-repeating decimal. The square root of any prime number is irrational, as are π and e.

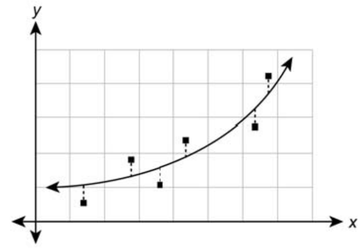
Least (or Lowest) Common Multiple (LCM) — The smallest number or expression that is a common multiple of two or more numbers or algebraic terms, other than zero.

Like Terms — Monomials that contain the same variables and corresponding powers and/or roots. Only the coefficients can be different (e.g., $4x^3$ and $12x^3$). Like terms can be added or subtracted.

Line Graph
A graph that uses a line or line segments to connect data points, plotted on a coordinate plane, usually to show trends or changes in data over time. More broadly, a graph to represent the relationship between two continuous variables.

Line or Curve of Best Fit (for a Scatter Plot)
A line or curve drawn on a scatter plot to best estimate the relationship between two sets of data. It describes the trend of the data. Different measures are possible to describe the best fit. The most common is a line or curve that minimizes the sum of the squares of the errors (vertical distances) from the data points to the line. The line of best fit is a subset of the curve of best fit. Examples of a line of best fit and a curve of best fit:





Linear Combination
A method by which a system of linear equations can be solved. It uses addition or subtraction in combination with multiplication or division to eliminate one of the variables in order to solve for the other variable.

Linear Equation
An equation for which the graph is a straight line (i.e., a polynomial equation of the first degree of the form $Ax + By = C$, where A, B, and C are real numbers and where A and B are not both zero; an equation in which the variables are not multiplied by one another or raised to any power other than 1).

Linear Function
A function for which the graph is a non-vertical straight line. It is a first degree polynomial of the common form $f(x) = mx + b$, where m and b are constants and x is a real variable. The constant m is called the slope and b is called the y-intercept. It has a constant rate of change.

Linear Inequality:
The relation of two expressions using the symbols <, >, ≤, ≥, or ≠ and whose boundary is a straight line. The line divides the coordinate plane into two parts. If the inequality is either ≤ or ≥, then the boundary is solid. If the inequality is either < or >, then the boundary is dashed. If the inequality is ≠, then the solution contains everything except for the boundary.

Logarithm
The exponent required to produce a given number (e.g., since 2 raised to a power of 5 is 32, the logarithm base 2 of 32 is 5; this is written as $\log_2 32 = 5$). Two frequently used bases are 10 (common logarithm) and e (natural logarithm). When a logarithm is written without a base, it is understood to be base 10.

Logarithmic Equation
An equation which contains a logarithm of a variable or number. Sometimes it is solved by rewriting the equation in exponential form and solving for the variable (e.g., $\log_2 32 = 5$ is the same as $2^5 = 32$). It is an inverse function of the exponential function.

Mapping
The matching or pairing of one set of numbers to another by use of a rule. A number in the domain is matched or paired with a number in the range (or a relation or function). It may be a one-to-one correspondence, a one-to-many correspondence, or a many-to-one correspondence.

Maximum Value (of a Graph)
The value of the dependent variable for the highest point on the graph of a curve.

Mean
A measure of central tendency that is calculated by adding all the values of a set of data and dividing that sum by the total number of values. Unlike median, the mean is sensitive to outlier values. It is also called "arithmetic mean" or "average".

Measure of Central Tendency
A measure of location of the middle (center) of a distribution of a set of data (i.e., how data clusters). The three most common measures of central tendency are mean, median, and mode.

Measure of Dispersion
A measure of the way in which the distribution of a set of data is spread out. In general the more spread out a distribution is, the larger the measure of dispersion. Range and interquartile range are two measures of dispersion.

Median
A measure of central tendency that is the middle value in an ordered set of data or the average of the two middle values when the set has two middle values (occurs when the set of data has an even number of data points). It is the value halfway through the ordered set of data, below and above which there are an equal number of data values. It is generally a good descriptive measure for skewed data or data with outliers.

Minimum Value (of a Graph)
The value of the dependent variable for the lowest point on the graph of a curve.

Mode
A measure of central tendency that is the value or values that occur(s) most often in a set of data. A set of data can have one mode, more than one mode, or no mode.

Monomial
A polynomial with only one term; it contains no addition or subtraction. It can be a number, a variable, or a product of numbers and/or more variables (e.g., $2 \cdot 5$ or x^3y^4 or $\frac{4}{3}\pi r^2$).

Multiplicative Inverse
The reciprocal of a number (i.e., for any non-zero number a, the multiplicative inverse is $\frac{1}{a}$; for any rational number $\frac{b}{c}$, where $b \neq 0$ and $c \neq 0$, the multiplicative inverse is $\frac{c}{b}$). Any number and its multiplicative inverse have a product of 1 (e.g., $\frac{1}{4}$ is the multiplicative inverse of 4 since $4 \cdot \frac{1}{4} = 1$; likewise, the multiplicative inverse of $\frac{1}{4}$ is 4 since $\frac{1}{4} \cdot 4 = 1$).

Mutually Exclusive Events
Two events that cannot occur at the same time (i.e., events that have no outcomes in common). If two events A and B are mutually exclusive, then the probability of A or B occurring is the sum of their individual probabilities: $P(A \cup B) = P(A) + P(B)$. Also defined as when the intersection of two sets is empty, written as $A \cap B = \varnothing$.

Natural Logarithm
A logarithm with base e. It is written ln x. The natural logarithm is the power of e necessary to equal a given number (i.e., $\ln x = y$ is equivalent to $e^y = x$). The constant e is an irrational number whose value is approximately 2.71828.…

Natural Number
A counting number. A number representing a positive, whole amount. Any number from the set of numbers represented by {1, 2, 3, …}. Sometimes, it is referred to as a "positive integer".

Negative Exponent
An exponent that indicates a reciprocal that has to be taken before the exponent can be applied (e.g., $5^{-2} = \frac{1}{5^2}$ or $a^{-x} = \frac{1}{a^x}$). It is used in scientific notation for numbers between $^{-}1$ and 1.

Number Line — A graduated straight line that represents the set of all real numbers in order. Typically, it is marked showing integer values.

Odds — A comparison, in ratio form (as a fraction or with a colon), of outcomes. "Odds in favor" (or simply "odds") is the ratio of favorable outcomes to unfavorable outcomes (e.g., the odds in favor of picking a red hat when there are 3 red hats and 5 non-red hats is 3:5). "Odds against" is the ratio of unfavorable outcomes to favorable outcomes (e.g., the odds against picking a red hat when there are 3 red hats and 5 non-red hats is 5:3).

Order of Operations — Rules describing what order to use in evaluating expressions:
(1) Perform operations in grouping symbols (parentheses and brackets),
(2) Evaluate exponential expressions and radical expressions from left to right,
(3) Multiply or divide from left to right,
(4) Add or subtract from left to right.

Ordered Pair — A pair of numbers used to locate a point on a coordinate plane, or the solution of an equation in two variables. The first number tells how far to move horizontally, and the second number tells how far to move vertically; written in the form (x-coordinate, y-coordinate). Order matters: the point (x, y) is **not** the same as (y, x).

Origin — The point (0, 0) on a coordinate plane. It is the point of intersection for the x-axis and the y-axis.

Outlier — A value that is much greater or much less than the rest of the data. It is different in some way from the general pattern of data. It directly stands out from the rest of the data. Sometimes it is referred to as any data point more than 1.5 interquartile ranges greater than the upper (third) quartile or less than the lower (first) quartile.

Pattern (or Sequence) — A set of numbers arranged in order (or in a sequence). The numbers and their arrangement are determined by a rule, including repetition and growth/decay rules. See arithmetic sequence and geometric sequence.

Perfect Square — A number whose square root is a whole number (e.g., 25 is a perfect square since $\sqrt{25} = 5$). A perfect square can be found by raising a whole number to the second power (e.g., $5^2 = 25$).

Permutation — An ordered arrangement of objects from a given set in which the order of the objects is significant (e.g., two-letter permutations of the three letters X, Y, and Z would be XY, YX, XZ, ZX, YZ, and ZY). A permutation is similar to, but not the same as, a combination.

Point-Slope Form (of a Linear Equation) — An equation of a straight, non-vertical line written in the form $y - y_1 = m(x - x_1)$, where m is the slope of the line and (x_1, y_1) is a given point on the line.

Polynomial — An algebraic expression that is a monomial or the sum or difference of two or more monomials (e.g., $6a$ or $5a^2 + 3a - 13$ where the exponents are natural numbers).

Polynomial Function — A function of the form $f(x) = a_nx^n + a_{n-1}x^{n-1} + \ldots + a_1x + a_0$, where $a_n \neq 0$ and natural number n is the degree of the polynomial.

Positive Exponent — Indicates how many times a base number is multiplied by itself. In the expression x^n, n is the positive exponent, and x is the base number (e.g., $2^3 = 2 \cdot 2 \cdot 2$).

Power

The value of the exponent in a term. The expression a^n is read "*a* to the power of *n*." To raise a number, *a*, to the power of another whole number, *n*, is to multiply *a* by itself *n* times (e.g., the number 4^3 is read "four to the third power" and represents $4 \cdot 4 \cdot 4$).

Power of a Power

An expression of the form $(a^m)^n$. It can be found by multiplying the exponents (e.g., $(2^3)^4 = 2^{3 \cdot 4} = 2^{12} = 4{,}096$).

Powers of Products

An expression of the form $a^m \cdot a^n$. It can be found by adding the exponents when multiplying powers that have the same base (e.g., $2^3 \cdot 2^4 = 2^{3+4} = 2^7 = 128$).

Prime Number

Any natural number with exactly two factors, 1 and itself (e.g., 3 is a prime number since it has only two factors: 1 and 3). [Note: Since 1 has only one factor, itself, it is not a prime number.] A prime number is not a composite number.

Probability

A number from 0 to 1 (or 0% to 100%) that indicates how likely an event is to happen. A very unlikely event has a probability near 0 (or 0%) while a very likely event has a probability near 1 (or 100%). It is written as a ratio (fraction, decimal, or equivalent percent). The number of ways an event could happen (favorable outcomes) is placed over the total number of events (total possible outcomes) that could happen. A probability of 0 means it is impossible, and a probability of 1 means it is certain.

Probability of a Compound (or Combined) Event

There are two types:

1. The union of two events A and B, which is the probability of A *or* B occurring. This is represented as $P(A \cup B) = P(A) + P(B) - P(A) \cdot P(B)$.
2. The intersection of two events A and B, which is the probability of A *and* B occurring. This is represented as $P(A \cap B) = P(A) \cdot P(B)$.

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Probability of a Compound (or Combined) Event

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1. The union of two events A and B, which is the probability of A *or* B occurring. This is represented as $P(A \cup B) = P(A) + P(B) - P(A) \cdot P(B)$.
2. The intersection of two events A and B, which is the probability of A *and* B occurring. This is represented as $P(A \cap B) = P(A) \cdot P(B)$.

Quadratic Formula

The solutions or roots of a quadratic equation in the form $ax^2 + bx + c = 0$, where $a \neq 0$, are given by the formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

Quadratic Function

A function that can be expressed in the form $f(x) = ax^2 + bx + c$, where $a \neq 0$ and the highest power of the variable is 2. The graph is a parabola.

Quartile

One of three values that divides a set of data into four equal parts:

1. Median divides a set of data into two equal parts.
2. Lower quartile (25th percentile) is the median of the lower half of the data.
3. Upper quartile (75th percentile) is the median of the upper half of the data.

Radical Expression

An expression containing a radical symbol ($\sqrt[n]{a}$). The expression or number inside the radical (a) is called the radicand, and the number appearing above the radical (n) is the degree. The degree is always a positive integer. When a radical is written without a degree, it is understood to be a degree of 2 and is read as "the square root of *a*." When the degree is 3, it is read as "the cube root of *a*." For any other degree, the expression $\sqrt[n]{a}$ is read as "the *n*th root of *a*." When the degree is an even number, the radical expression is assumed to be the principal (positive) root (e.g., although $(^-7)^2 = 49$, $\sqrt{49} = 7$).

Range (of a Relation or Function)

The set of all possible values for the output (dependent variable) of a function or relation; the set of second numbers in the ordered pairs of a function or relation; the values of the y-coordinates in (x, y).

Repeating Decimal

A decimal with one or more digits that repeats endlessly (e.g., 0.666…, 0.727272…, 0.08333…). To indicate the repetition, a bar may be written above the repeated digits (e.g., 0.666… = $0.\overline{6}$, 0.727272… = $0.\overline{72}$, 0.08333… = $0.08\overline{3}$). A decimal that has either a 0 or a 9 repeating endlessly is equivalent to a terminating decimal (e.g., 0.375000… = 0.375, 0.1999… = 0.2). All repeating decimals are rational numbers.

Rise

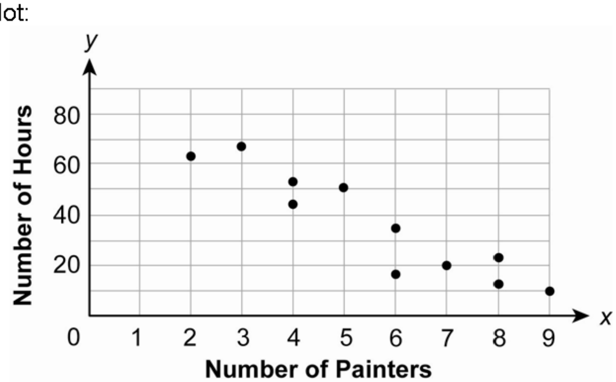
The vertical (up and down) change or difference between any two points on a line on a coordinate plane (i.e., for points (x_1, y_1) and (x_2, y_2), the rise is $y_2 - y_1$). See slope.

Run

The horizontal (left and right) change or difference between any two points on a line on a coordinate plane (i.e., for points (x_1, y_1) and (x_2, y_2), the run is $x_2 - x_1$). See slope.

Scatter Plot

A graph that shows the "general" relationship between two sets of data. For each point that is being plotted there are two separate pieces of data. It shows how one variable is affected by another. Example of a scatter plot:



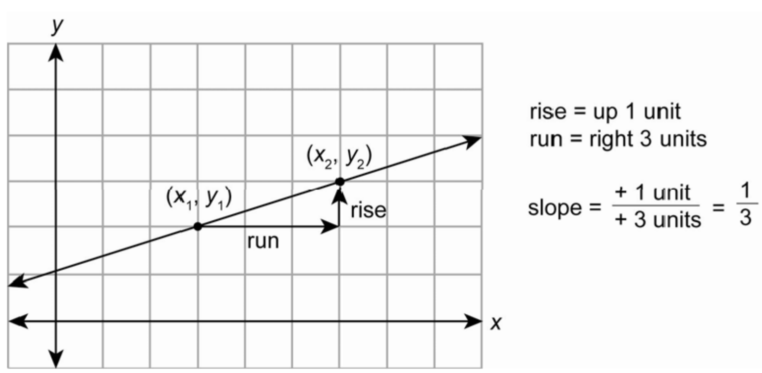
GLOSSARY

Simple Event — When an event consists of a single outcome (e.g., rolling a number cube).

Simplest Form (of an Expression) — When all like terms are combined (e.g., $8x + 2(6x - 22)$ becomes $20x - 44$ when in simplest form). The form which no longer contains any like terms, parentheses, or reducible fractions.

Simplify — To write an expression in its simplest form (i.e., remove any unnecessary terms, usually by combining several or many terms into fewer terms or by cancelling terms).

Slope (of a Line) — A rate of change. The measurement of the steepness, incline, or grade of a line from left to right. It is the ratio of vertical change to horizontal change. More specifically, it is the ratio of the change in the y-coordinates (rise) to the corresponding change in the x- coordinates (run) when moving from one point to another along a line. It also indicates whether a line is tilted upward (positive slope) or downward (negative slope) and is written as the letter m where $m = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$. Example of slope:



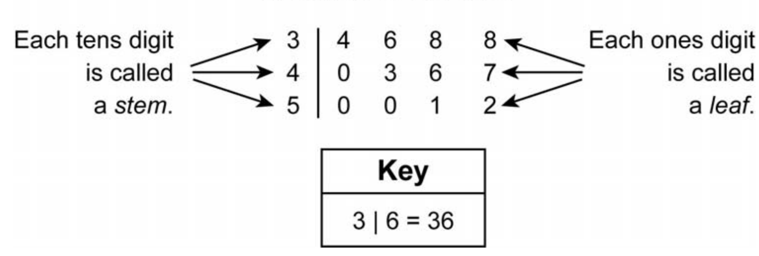
Slope-Intercept Form — An equation of a straight, non-vertical line written in the form $y = mx + b$, where m is the slope and b is the y-intercept.

Square Root — One of two equal factors (roots) of a number or expression; a radical expression ($\sqrt{a}$) with an understood degree of 2. The square root of a number or expression is assumed to be the principal (positive) root (e.g., $\sqrt{49x^4} = 7x^2$). The square root of a negative number results in an imaginary number (e.g., $\sqrt{-49} = 7i$).

Standard Form (of a Linear Equation) — An equation of a straight line written in the form $Ax + By = C$, where A, B, and C are real numbers and where A and B are not both zero. It includes variables on one side of the equation and a constant on the other side.

Stem-and-Leaf Plot — A visual way to display the shape of a distribution that shows groups of data arranged by place value; a way to show the frequency with which certain classes of data occur. The stem consists of a column of the larger place value(s); these numbers are not repeated. The leaves consist of the smallest place value (usually the ones place) of every piece of data; these numbers are arranged in numerical order in the row of the appropriate stem (e.g., the number 36 would be indicated by a leaf of 6 appearing in the same row as the stem of 3). Example of a stem-and-leaf plot:

Number of Sit-ups



Substitution — The replacement of a term or variable in an expression or equation by another that has the same value in order to simplify or evaluate the expression or equation.

System of Linear Equations — A set of two or more linear equations with the same variables. The solution to a system of linear equations may be found by linear combination, substitution, or graphing. A system of two linear equations will either have one solution, infinitely many solutions, or no solutions.

System of Linear Inequalities — Two or more linear inequalities with the same variables. Some systems of inequalities may include equations as well as inequalities. The solution region may be closed or bounded because there are lines on all sides, while other solutions may be open or unbounded.

Systems of Equations — A set of two or more equations containing a set of common variables.

Term — A part of an algebraic expression. Terms are separated by either an addition symbol (+) or a subtraction symbol (–). It can be a number, a variable, or a product of a number and one or more variables (e.g., in the expression $4x^2 + 6y$, $4x^2$ and $6y$ are both terms).

Terminating Decimal — A decimal with a finite number of digits. A decimal for which the division operation results in either repeating zeroes or repeating nines (e.g., 0.375000… = 0.375, 0.1999… = 0.2). It is generally written to the last non-zero place value, but can also be written with additional zeroes in smaller place values as needed (e.g., 0.25 can also be written as 0.2500). All terminating decimals are rational numbers.

Trinomial — A polynomial with three unlike terms (e.g., $7a + 4b + 9c$). Each term is a monomial, and the monomials are joined by an addition symbol (+) or a subtraction symbol (–). It is considered an algebraic expression.

Unit Rate — A rate in which the second (independent) quantity of the ratio is 1 (e.g., 60 words per minute, $4.50 per pound, 21 students per class).

Variable — A letter or symbol used to represent any one of a given set of numbers or other objects (e.g., in the equation $y = x + 5$, the y and x are variables). Since it can take on different values, it is the opposite of a constant.

Whole Number — A natural number or zero. Any number from the set of numbers represented by {0, 1, 2, 3, …}. Sometimes it is referred to as a "non-negative integer".

***x*-Axis** — The horizontal number line on a coordinate plane that intersects with a vertical number line, the y-axis; the line whose equation is $y = 0$. The x-axis contains all the points with a zero y-coordinate (e.g., (5, 0)).

***x*-Intercept(s)** — The x-coordinate(s) of the point(s) at which the graph of an equation crosses the x-axis (i.e., the value(s) of the x-coordinate when $y = 0$). The solution(s) or root(s) of an equation that is set equal to 0.

***y*-Axis** — The vertical number line on a coordinate plane that intersects with a horizontal number line, the x-axis; the line whose equation is $x = 0$. The y-axis contains all the points with a zero x-coordinate (e.g., (0, 7)).

***y*-Intercept(s)** — The y-coordinate(s) of the point(s) at which the graph of an equation crosses the y- axis (i.e., the value(s) of the y-coordinate when $x = 0$). For a linear equation in slope-intercept form ($y = mx + b$), it is indicated by b.

Credits & Kudos

PDESAS
http://www.pdesas.org/

Harrisburg School District Math Wikispace
http://hbgsdmath.wikispaces.com/Keystone+Materials

North Allegheny Intermediate High School
http://www.northallegheny.org/Page/13728

Harrisburg School District

- Diane Harris, GEAR UP Math Coach
- Bob Moreland, SIG Math Transformation Consultant
- Connie Shatto, GEAR UP Math Coach
- Autumn Calnon, Special Ed Teacher
- Dave MacIntire, Math Teacher
- Eric Croll, Math Teacher

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